ALLIED PAPER, INC./PORTAGE CREEK/ KALAMAZOO RIVER SUPERFUND SITE REMEDIAL INVESTIGATION/ FEASIBILITY STUDY

FIELD SAMPLING PLAN

Kalamazoo River Study Group

Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site

July 1993

BLASLAND & BOUCK ENGINEERS, P.C.
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DISCLAIMER

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PREFACE

This Field Sampling Plan (FSP) supports the Remedial Investigation/ Feasibility Study (RI/FS) Work Plan prepared on behalf of the Kalamazoo River Study Group (KRSG) by Blasland & Bouck Engineers, P.C. (Blasland & Bouck). The FSP sets forth the methods to be used in the RI/FS field investigations.

A Quality Assurance Project Plan (QAPP) has been developed for the RI/FS investigations. The QAPP is comprehensive for all Operable Units, mill investigations, and Kalamazoo River and Portage Creek field activities. Separate FSPs have been developed specifically for the RI/FS and individual Operable Unit Remedial Investigation/Focused Feasibility Studies (RI/FFS).

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APPENDICES

SECTION 1 - INTRODUCTION

1.1 General

This Field Sampling Plan (FSP) was prepared to document field sampling procedures in support of the Remedial Investigation/Feasibility Study (RI/FS) to be conducted at the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site and certain other areas required by the Michigan Department of Natural Resources (MDNR). The areas being investigated under this FSP (the Site) include the Kalamazoo River from Morrow Lake Dam to Lake Michigan, Portage Creek from Alcott Street to its confluence with the Kalamazoo River, Georgia-Pacific Corporation Kalamazoo Mill property, Simpson Plainwell Paper Company Mill property, Portage Paper Mill property, former King Mill property, former Monarch Mill property and the King Street Storm Sewer. This FSP provides details on sampling objectives, locations and frequency of sampling, sampling and field procedures for each matrix being investigated, sample handling and documentation, and field quality assurance/quality control (QA/QC) procedures.

The procedures specified herein will be used for sampling soil, paper residuals, sediment (in-stream and floodplain), and surface water. Laboratory and applicable QA/QC procedures for the collected samples are discussed in a separate document entitled the Quality Assurance Project Plan (QAPP) (Blasland & Bouck, 1993a). The field procedure(s) used in obtaining a given sample may have a significant effect on analytical data generated from that sample. Therefore, it is imperative that standardized protocols be utilized and that sample integrity and quality assurance standards be maintained during site investigations and environmental sampling events.

This FSP fulfills a requirement of the Allied Paper, Inc., Portage Creek/Kalamazoo River Superfund Site Administrative Order by Consent (AOC), which became effective on December 28, 1990, between the MDNR and members of the Kalamazoo River Study Group (KRSG). This plan is intended to complement the QAPP which together dictate the QA/QC and field sampling procedures that will be followed during the RI/FS. The FSP is subject to modifications where unforeseen sampling difficulties present themselves, and will be updated to reflect collection of any additional data not covered by the current version of this plan. The rationale used to prepare this FSP is embodied in the RI/FS Work Plan. All figures cited are located in the RI/FS Work Plan.

1.2 Sampling Objectives

The objectives of the field sampling activities are to collect samples that will be used to further characterize the Site. The results of the RI will provide data to be used in preparation of the Endangerment Assessment (EA) and the assessment of remedial alternatives during the FS.

The goals of the RI as stated in the AOC are to:

- Characterize the nature of the paper residuals at the Site;
- Define regulated constituent sources at the Site;
- Determine the vertical and horizontal extent of regulated constituents originating at the Site;
- Spatially quantify regulated constituents to the extent necessary to enable preparation of an EA and a FS, and to the extent that such constituents may be attributable to the Site;

- Identify potential regulated constituent migration pathways and movement; and
- Quantify public health and environmental risk.

1.3 Areas To Be Investigated

The areas to be investigated are listed in the following subsections. These areas are more fully described in the DCS Report (Blasland & Bouck, 1992) and the RI/FS Work Plan.

1.3.1 Kalamazoo River/Portage Creek

For purposes of the RI/FS, the Kalamazoo River and Portage Creek have been divided into the following ten segments:

- Portage Creek from Alcott Street to the Confluence with the Kalamazoo River (Figure 4);
- Morrow Lake Dam to the Portage Creek Confluence (Figures 3 and 4);
- Portage Creek Confluence to Main Street, Plainwell (Figures 4, 5, 6, and 7);
- Main Street, Plainwell to the Plainwell Dam (Figure 7);
- Plainwell Dam to the Otsego City Dam (Figure 7);
- Otsego City Dam to the Otsego Dam (Figures 7 and 8);
- Otsego Dam to the Trowbridge Dam (Figure 8);
- Trowbridge Dam to Allegan City Dam (Figure 9);
- Allegan City Dam to Lake Allegan Dam (Figures 9 and 10);
- Lake Allegan Dam to Lake Michigan (Figures 11, 12, and 13).

1.3.2 Mills and Storm Sewer

The mills and adjacent areas to be investigated are:

- Georgia-Pacific Corporation Kalamazoo Mill property (Figure 14);
- Simpson Plainwell Paper Company Mill property (Figure 15);
- Portage Paper Mill property (Figure 16);
- Former King Mill property (Figure 17);
- Former Monarch Mill property (Figure 18); and
- King Street Storm Sewer outfall area (Figure 19).

SECTION 2 - SAMPLING AND FIELD PROCEDURES

2.1 Introduction

As part of the various field investigations, several standard field procedures will be performed. They include:

1. In-River Sediment Sampling;
2. Exposed Former Impoundment Sediment Sampling;
3. Floodplain Soil Sampling;
4. Soil/Residual Boring Drilling and Sampling;
5. Solids/Sediment Sampling;
6. Surface Water Sampling; and
7. Work Area Air Monitoring

This section of the FSP introduces and references the appropriate detailed procedures in the appendices, including ancillary procedures for equipment cleaning, field measurements, and calibration and maintenance of field instruments. Sample handling, packing, and shipping procedures together with field QA/QC requirements are described in Section 3. All sample locations, analytical constituents and parameters, and geotechnical analyses for the following sections are summarized in Tables 2-1 through 2-8.

2.2 In-River Sediment Sampling

A summary of the in-stream sediment sampling activities conducted on the Kalamazoo River and Portage Creek is contained in Table 2-1.

2.2.1 Sediment Characterization

To provide information related to present-day conditions as well as river flow dynamics and the effects of these dynamics on in-stream sediment patterns, between 12 to 26 transects will be subject to sediment probing in each of the following reaches of the Kalamazoo River and Portage Creek:

- Alcott Street on Portage Creek to the confluence with the Kalamazoo River (Figure 4);
- Davis Creek Confluence to Main Street, Plainwell (Figure 4);
- Main Street, Plainwell to the Plainwell Dam (Figure 7);
- Plainwell Dam to Otsego City Dam (Figure 8);
- Otsego City Dam to Otsego Dam (Figures 7 and 8);
- Otsego Dam to the Trowbridge Dam (Figure 8);
- Trowbridge Dam to the Allegan City Line (Figure 9);
- Allegan City Line to Allegan City Dam (Figure 9);
- Allegan City Dam to the Lake Allegan Dam (Figures 9 and 10); and
- Koopman Marsh/Swan Creek Marsh Area (Figure 11).

For each segment, the distance between transects will be approximately equidistant. However, the spacing of transects in each segment will be a function of the segment length with the longer the segment the further the distance between transects (See Table 2-1 for the number of transects per segment). Along each transect an average of six to eight equidistant points will be probed using metal rods and hand-coring equipment. For the segment on Portage Creek, the number of points along a transect will

likely be less than that for the Kalamazoo River because of the Creek's smaller width.

Soft sediment areas penetratable by a metal rod will be considered sediment deposits and will be sampled using a clear Lexan® tube for visual inspection. The Lexan® tubing will be hand driven to refusal. In addition, pending the acceptance of preservation of sediment samples for PCB analysis as described in the June 16, 1993 QAPP, cores will be retained at approximately 700 locations for possible PCB analysis. In addition to visual inspection, all cores retained will be photographed along with the executed form in Appendix A. The position of each transect will be identified in the field on enlarged aerial photographs and surveyed to accurately record its location. Information regarding the procedures, methods, and equipment to be utilized for sampling are found in Appendix A.

For each sediment probing point, the following information will be obtained and recorded:

- Location;
- Depth of sediment (depth of refusal);
- Depth of water;
- Grain-size characterization (fine-grain vs. coarse-grained)
- Secondary sediment descriptions (i.e., color, presence of debris, types of coarse material, or paper residues);
- Water velocity at 0.6 times the depth at 20 to 25 percent of transects;
- River physical features; and

- Other appropriate field conditions and observations.

The upper four inches of cores will be cataloged and retained for possible future physical properties analyses.

The river flow velocity will be determined using an electromagnetic current velocity meter at selected locations. Approximately 20 to 25 percent of the transects will undergo water velocity measurements at each probing point location. This will provide sufficient detail to characterize water velocities for various reaches and provide data for calibration of hydraulic models in the future should they be necessary. Methods, procedures, and equipment for measuring river flow velocity are described in Appendix C.

2.2.2 Geostatistical Sampling Approach Pilot Study

At the direction of MDNR, a pilot study will be conducted as part of the RI activities to assess the feasibility of using a geostatistical approach to the characterization of sediment-related polychlorinated biphenyls (PCBs) deposition within the Kalamazoo River. A one-mile reach of the Kalamazoo River upstream of the former Trowbridge Dam (Figure 8) has been selected as the location for the geostatistical pilot study.

A total of 62 sampling locations will be used in this pilot study (Figure 20). At each sediment sampling location in the geostatistical pilot study area, a sediment core sample will be collected using a clear Lexan® tubing as described in Appendix A. The goal of the sampling will be to obtain a core which passes through all grey, clay paper residuals into underlying native soils. A minimum core depth of three feet is an objective but may not be obtainable at all locations. The location, depth of core,

and lithologic description will be noted for all cores. Samples for analysis of PCBs will be taken from the upper one-foot interval and the deepest one-foot interval above any identifiable residual/native soil interface of each core. If no interface is identifiable the sample will be taken from the deepest one foot interval of the core. Photographs will be taken of each core sample. The collection of sediment cores will follow the protocols in Appendix A.

2.2.3 Geochronological Dating of Sediment and PCB Deposition

To provide information on the approximate rates of historic sediment deposition and the transport history of PCBs, cores from the Allegan City Dam Impoundment (Figure 9) and cores from Kalamazoo Lake (Figure 13) will be analyzed for the radioactive isotope cesium-137 (Cs-137).

The sediment dating work will be performed in two phases. In the initial phase two cores will be collected from different locations in each area following the procedures in Appendix A. Cores will be sectioned at one-foot intervals and analyzed for Cs-137. This resulting coarse Cs-137 profile will be used to set the core sectioning interval to be applied to two additional cores to be collected from each of these impoundments. Each additional core will be segmented into relatively thin sections for analysis of Cs-137 and PCBs. The upper section(s) of each core will also be analyzed for the presence of beryllium-7 (Be-7) to assure the surface layer of the sediment has been retrieved during the coring.

2.2.4 Source Investigation - Sediment Sampling

Sixteen areas have been identified in the Kalamazoo River between Morrow Lake and Lake Allegan for sediment sampling to assess the

potential influx of PCBs from sources other than those potential sources previously identified (i.e., OUs, mills, King Street Storm Sewer). Targeted areas for sediment sampling include the immediate areas of discharge or the first downstream area on the same side of the Kalamazoo River, which based upon physical features and the results of sediment characterization, would seem to favor the accumulation of fine-grained sediments.

Two sediment cores will be obtained using Lexan^{R} tubing (Appendix A) at each of the targeted sampling locations (Figures 3 to 9). The top six inches of sediment from each core will be analyzed for PCBs and total organic carbon (TOC). Below the 0 to 6-inch interval, the sediment core will be sectioned into samples representing the 6- to 12-inch increment and each one-foot increment thereafter to the total depth of sediment (refusal) or specified target depth is achieved. This target depth will be determined on a location-by-location basis, depending on existing sediment PCB concentration data. At locations of coarse-grained materials, cores will not be obtained. Surface grab sediment sampling techniques will be used in case no core can be retrieved. Each increment sample below the surficial interval will be analyzed for PCBs.

Field observations noted for every sediment core collected for PCB analysis will include the location and depth of grain-size characterization (fine- versus coarse-grained), depth of sediment, water velocity, and other relevant data. The procedures for measuring water velocity are located in Appendix C.

2.3 Exposed Former Impoundment Sediment Sampling

The removal of the Plainwell, Otsego, and Trowbridge dams by the MDNR to their sill elevation resulted in significant volumes of historical river sediments being released and exposed above the current river water line. Therefore, an investigation will be undertaken to provide an assessment of PCB distribution within these areas. This investigation will include the establishment of six transects within the former Plainwell Dam and Otsego Dam Impoundments (Figures 7 and 8) and nine transects within the former Trowbridge Dam Impoundment (Figure 8). A summary of the exposed former impoundment sediment deposit sampling activities is found in Table 2-1. The lateral extent of the transect will be determined on the basis of three alternative criteria. These alternative criteria are:

- The extension of the transect until sediment/soil PCB concentrations are below detection (1 milligrams per kilogram [mg/kg]) using the immunoassay screening technique. Immunoassay PCB-testing procedures are presented in Appendix H;
- The extension of the transect until the native soil/gray paper waste interface is identified (used only if the correlation between non-detectable PCB concentration and the interface can be established); or
- The extension of the transect until a physical barrier to sediment deposition, such as a steep bank, can be identified.

Along each transect in the former Plainwell Dam and Otsego Dam Impoundments, five sample locations will be established (Figure 7). Along each transect in the former Trowbridge Dam Impoundment (Figure 8), eight sample

locations will be established. Each sample location will be surveyed to accurately record its location and elevation. Each core sample will extend through all residuals and into native soil using methods specified in Appendix B. If there is evidence of residuals at the bottom of the core a new deeper core will be taken adjacent to the first. At each of these locations, samples for PCB analysis will be collected from the 0 to 6-inch interval and each subsequent one-foot interval to depth of refusal. The 0 to 6-inch interval for all cores and the deeper intervals for half the cores will be analyzed for TOC content. Every sample will be described using the Unified Soil Classification System and will be photographed.

Three sample locations per impoundment will also be selected for a material characterization analysis. At these locations, undisturbed samples will be collected using a thin-walled tube sampler (Appendix B) at 6-inch intervals with geotechnical analyses being performed for physical characterization including consolidation, particle size, percent moisture, and density.

One sample location per impoundment (to be selected in the field) will be screened for Contract Laboratory Program Target Compound List/Target Analyte List (CLP TCL/TAL) constituents. These samples will be taken from the 0 to 6-inch and 6- to 18-inch interval and analyzed.

2.4 Floodplain Soil Sampling

A phased approach will be taken to assess PCB occurrence in floodplain soils. Available flood information was used to determine the 100-year (yr) floodplain prior to the pre-draw down period. Based on this characterization, select sampling locations were defined. A total of five river transects will be

established between the confluence with Portage Creek and the city of Allegan. The transects extend to the approximate boundary of the 100-yr floodplain and are shown in Figures 4 through 8. A summary of the floodplain soil sampling activities is found in Table 2-1.

The locations for these five transects from the most upstream location downstream are as follows:

- Verburg Park south of Paterson Street in Kalamazoo (Figure 4);
- South of D avenue on land owned by the Cooper Township (Figure 5);
- Brookside Park in Otsego (Figure 6);
- an extension of a exposed former impoundment sediment transect located in the former Otsego Dam Impoundment (Figure 7); and
- Downstream of the former Trowbridge Dam (the specific location will be defined when land ownership is determined and access granted) (Figure 8).

The transects established at Verburg Park and south of D Avenue will include only transects on the west bank, and the Brookside Park transect will include only the south bank because the west and north sides of the respective locations are privately owned.

Each transect will have eight locations sampled within the 100-yr floodplain elevation with a bias towards sampling locations closer to the river. The location and elevation of each sample location will be accurately surveyed. Samples will be collected at 0 to 6-inches and 6- to 12-inches using a hand-driven, split-spoon sampler (Appendix B) and analyzed for PCBs. If a split-spoon method is not sufficient, then a thin-walled piston sampler or a coring device will be used. The two locations nearest the river will have an additional

12- to 24-inch deep sample collected for PCB analysis. TOC content will be analyzed for the 0 to 6-inch interval sample only. Samples collected near the 100-yr floodplain boundary will undergo PCB analysis using the immunoassay field screening method.

If samples taken near the 100-yr floodplain boundary along a transect have detectable PCB concentrations of greater than 1 mg/kg based on the field screening methods (Appendix H), then the transect will be extended further from the river until the soil PCB concentration is less than detection (<1 mg/kg). The distance outward from the 100-yr floodplain for the subsequent sample will be determined in the field based on topography. Once the boundary of PCB contamination has been determined, sampling will proceed along the transect towards the River.

The soil and floodplain investigation of Portage Creek will be conducted at two locations: the Portage Paper Mill property north of Reed Street and near the Upjohn Park located adjacent to the Crosstown Parkway (Figure 3). The area north of Reed Street will have a total of five randomly placed sampling locations, transects will not be used. At the Upjohn Park area, a Portage Creek transect will be established and a total of five sampling locations will be placed along the transect. The transect will extend laterally to Portage Creek's 100-yr floodplain boundaries. Sampling will be performed at six-inch intervals to a depth of 12 inches below the surface using a hand-driven, split-spoon sampler described in Appendix B. If a split-spoon method is not appropriate, then a thin-walled piston sampler or a coring device will be used. The 0 to 6-inch interval will be analyzed for both TOC and PCBs and the 6- to 12-inch interval will be analyzed for PCBs.

In addition, the Koopman Marsh/Swan Creek Marsh Area (Figure 11) downstream of the Lake Allegan Dam will be investigated to assess the extent of PCB deposition. Floodplain soils will be collected using a split spoon sampler along 3 transects with each transect having 5 core sampling points. The cores will be collected at 100-foot intervals along the transect with the upper six inches being sampled for PCBs and TOC. The 6- to 12-inch interval and the 12- to 24-inch interval will only be analyzed for PCBs. The locations and lithologic descriptions will be recorded for each sample.

To assess whether the Ottawa and Pottowatamie marshes are acting as sinks for chemicals, three cores will be collected from each of these areas. The approximate locations of cores OM-1, OM-2, OM-3 are shown on Figures 11 and 12. The approximate locations of cores PM-1, PM-2, and PM-3 are shown on Figure 13. These locations may be adjusted in the field to areas of observed flooding and reasonable access. The 0- to 2-inch, 2- to 6-inch, 6- to 12-inch, 12- to 24-inch, and 24- to 36-inch intervals will be analyzed for PCBs. For one of the three cores at each marsh, the 2 - to 6-inch interval will be analyzed for CLP TCL/TAL constituents, not PCBs only.

If the results of the first phase of this investigation indicates a significant issue involving floodplain soils contamination then a second phase of additional sampling and a more in-depth analysis of flood history will be performed.

2.5 Soils/Residuals Boring Samples

2.5.1 Georgia-Pacific Corporation Kalamazoo Mill Property

The locations of the former lagoons at the Georgia-Pacific Corporation Kalamazoo Mill are shown on Figure 14. These lagoons will be investigated

to characterize the nature and extent of the residuals. A total of seven soil borings, to be designated GPL-1 through GPL-7, will be drilled to characterize the former lagoons. These borings will be continuously sampled following the protocols in Appendix B with a hand auger or 2-foot split-barrel (split-spoon) sampler for visual classification. If the split-spoon method is not sufficient, then a thin-walled piston sampler or coring device will be used. Selected samples will be homogenized and analyzed for PCBs as described below.

Three borings (GPL-1 through GPL-3) will be drilled in the three former lagoons to the northwest of the mills. Given the location near the Kalamazoo River and the local relief, the lagoons appear to have been shallow and have not been filled in. Consequently, if residuals are present, the layer is expected to be thin (<5 feet).

Prior to the installation of borings in the former lagoons to the northwest of the mills, a preliminary field determination of the horizontal extent of residuals inside and outside of the lagoons will be conducted. The field determination will consist of turning over the top one foot of soil with a hand shovel at a number of locations to identify the underlying material as either native soil or residuals. The residuals are distinguishable from native soil or sediment by their characteristic grayish-white, clay-like appearance.

Borings GPL-1, GPL-2 and GPL-3 will be advanced to a depth of 2.5 feet below the base of the residuals. Borings GPL-1 and GPL-3 will be advanced through the edge of the residuals piles. The borings will be visually inspected to assess the presence and vertical extent of paper

residuals. At each boring one surface sample from 0 to 6 inches below the surface will be homogenized and analyzed for PCBs. A soil sample collected from 0.5 to 2.5 feet below the base of the residuals from each of borings GPL-1, GPL-2 and GPL-3 will be homogenized and analyzed for PCBs. If an identifiable interface is observed between the base of the residuals and native soil, the native soil sample interval may be modified to allow collection of a representative sample of the native soil below the interface. The specific location will be identified in the field.

Samples in this phase will be allocated based upon the reconnaissance observations of the extent of the residuals around the lagoons including the former drainage way from the lagoons to the Kalamazoo River.

Borings GPL-4 and GPL-5 will be installed in the two former lagoons located near the primary clarifier (Figure 14). These borings will be advanced to a depth of 2.5 feet below the base of the residuals. At each boring, one surface sample from 0 to 6 inches will be analyzed for PCBs. If residuals are not contained in the 0 to 6-inch sample, then an underlying sample of residuals, if present, will be collected for PCB analysis. A sample from 0.5 to 2.5 feet below the base of the residuals, if present would be homogenized and analyzed for PCBs. One reconnaissance boring (GPL-6 and GPL-7) will also be installed in each of the lagoons to assess the presence and vertical extent of residuals (if present). These borings will also be advanced to a depth 2.5 feet below the base of residuals. No chemical analysis will be performed on borings GPL-6 and GPL-7. If an identifiable interface is observed between the base of the residuals and native soil, the native soil sample interval may be modified to allow

collection of a representative sample of the native soil below the interface. The specific location will be identified in the field.

The sampling activities at Georgia-Pacific Corporation Kalamazoo Mill property are summarized in Table 2-2. Installation and sampling procedures for all borings are described in the Appendix B.

2.5.2 Simpson Plainwell Paper Company Mill Property

The locations of the former lagoons at the Simpson Plainwell Paper Company Mill are shown on Figure 15. These lagoons will be investigated to characterize the residuals which may be present at these locations. A review of aerial photographs indicates that the former lagoon boundaries appear to be distinct. For this reason, the borings to be installed as part of the mill property investigations are focused within the lagoons.

A total of 13 soil borings, designated SPL-1 through SPL-13, will be installed to characterize the lagoons. These borings will be continuously sampled with a 2-foot split-barrel (split-spoon) sampler as described in Appendix B for visual classification and for standard penetration resistance testing. If a split-spoon method is not sufficient, then a thin-walled piston sampler or a coring device will be used.

Borings SPL-1 through SPL-4 and SPL-6 through SPL-13 will be installed in the row of 13 former lagoons shown in Figure 15. Boring SPL-5 will be installed in former lagoon K. The borings will be advanced to a depth 2.5 feet below the base of the residuals or fill material. If an identifiable interface is observed between the base of the residuals and native soil, the native soil sample interval may be modified to allow collection of a representative sample of the native soil below the interface.

The specific location will be identified in the field. Visual classification of the soil encountered at each boring will be made to verify the vertical extent of the residuals or lagoons. Boring SPL-1 through SPL-5 will be analyzed for PCBs if residuals are encountered. If residuals are not encountered, then borings within the set SPL-7 through SPL-13 will be substituted for PCB analysis. From each of the five selected borings, one surface sample from 0 to 6 inches will be homogenized and analyzed for PCBs. A sample of any underlying residuals will be collected for every 10 feet of residuals. Residuals, if present, are expected to be in a thin layer (<5 feet); consequently, one sample is expected when residuals are encountered. From each of the five borings selected for PCB analysis, a sample from 0.5 to 2.5 feet below the base of the residuals will also be homogenized and analyzed for PCBs. If an identifiable interface is observed between the base of the residuals and native soil, the native soil sample interval may be modified to allow collection of a representative sample of the native soil below the interface. The specific location will be identified in the field.

Boring SPL-6 will be installed in the area of the former aeration basin. This boring will be advanced to a depth of 2.5 feet below the base of the former basin sediment. A sample of the sediment, if present, or the surface (0 to 6 inches) will be analyzed for PCBs. A sample from 0.5 to 2.5 feet below the base of the sediment/fill will be homogenized and analyzed for PCBs. If an identifiable interface is observed between the base of the residuals and native soil, the native soil sample interval may be modified to allow collection of a representative sample of the native soil

below the interface. The specific location will be identified in the field. In addition to the proposed soil boring program to characterize any residuals remaining in the former lagoons, residuals, if discovered during mill construction activities at the mill during the course of the RI, would be characterized as part of this investigation.

Sampling activities at the Simpson Plainwell Paper Company are summarized in Table 2-3. Installation and abandonment procedures for all borings are described in Appendix B.

2.5.3 Former King Mill Property

The locations of the former lagoons as shown on Figure 17 will be investigated to characterize the horizontal and vertical extent and the nature of the residuals placed or dewatered at these locations. The areas where the former clarifiers stood will also be assessed.

A total of eight soil borings (KM-1 through KM-8) will be installed to investigate the former lagoons and former clarifiers. These borings will be continuously sampled with a 2-foot split-barrel (split-spoon) sampler as described in Appendix B for visual classification. If a split-spoon method is not sufficient, then a thin-walled piston sampler or coring device will be used. Selected samples will be homogenized and analyzed for PCBs, as described below.

Borings KM-1 and KM-2 will be installed at the locations of the former clarifiers, as shown on Figure 17. These borings will be advanced to a depth of four feet. Two 2-foot split-spoon samples will be collected at each of these borings. If a split-spoon method is not sufficient, then a thin-walled piston sampler or coring device will be used. The top 6-inch

increment of the surface sample (0 to 6-inch) and the second 2-foot sample (2- to 4-foot) will be homogenized and analyzed for PCBs.

Three borings (KM-3 through KM-5) will be installed in the former north-south, elongated lagoon. The borings will be preceded by a field reconnaissance of the area to determine the horizontal extent of residuals in the lagoon and to assess the presence of paper residuals outside the lagoon boundaries. The reconnaissance will consist of turning over one-foot of soil with a hand shovel and identifying the underlying material as native soil or residuals. Preliminary reconnaissance indicates that the residuals of former King Mill are confined to the former lagoon. Borings KM-3 through KM-5 will be advanced to a depth of 2.5 feet below the base of the residuals. Borings KM-3 and KM-5 will be used only for the determination of the vertical extent of paper residuals within the lagoon and no chemical analysis will be conducted on the soil samples collected at these borings. At boring KM-4, a surface sample from 0 to 6 inches will be analyzed for PCBs. A separate sample of the residuals, if present in a distinct layer, will be collected and analyzed for PCBs. A soil sample, collected from 0.5 to 2.5 feet below the base of the residuals, will be homogenized and analyzed for PCBs from borings KM-4. If an identifiable interface is observed between the base of the residuals and native soil, the native soil sample interval may be modified to allow collection of a representative sample of the native soil below the interface. The specific location will be identified in the field.

Three borings (KM-6 through KM-8) will be installed in the former northeast lagoon. Preliminary site reconnaissance has yet to confirm the

presence or exact location of this lagoon which had been located to the northeast of the elongated lagoon. Additional reconnaissance will be conducted with a hand shovel to assess the presence and horizontal extent of residuals in the area of this former lagoon prior to installing borings. Borings KM-6 through KM-8 will be installed within the boundaries of this former lagoon when defined by reconnaissance. These borings will be advanced to a depth of 2.5 feet below the base of the residuals. If an identifiable interface is observed between the base of the residuals and native soil, the native soil sample interval may be modified to allow collection of a representative sample of the native soil below the interface. The specific location will be identified in the field. Borings KM-6 and KM-8 will be used only for the determination of the vertical extent of paper residuals within the lagoon and no chemical analysis will be conducted on the soil samples collected at these borings. At boring KM-7, samples for PCBs will be collected using the approach described above for boring KM-4.

Samples in this phase will be allocated based upon the reconnaissance observations of the extent of the residuals around the lagoons.

Sampling activities at the former King Mill property are summarized in Table 2-5. Installation and abandonment procedures for all borings are described in Appendix B.

2.5.4 Former Monarch Mill Property

Two borings (MM-1 and MM-2) will be installed along the northern side of the property (just south of Cork Street) at locations down-gradient of the mill where the mill race had discharged to Portage Creek (Figure 18). The

locations apparently were covered with fill during dismantling of the mill in 1980.

A sample will be collected at each boring with a 2-foot split-spoon sampler at the depth where mill race sediments are encountered. If a split-spoon sampling method is not sufficient, then a thin-walled piston sampler or a coring device will be used. If no sediments are encountered by 15 feet depth or if auger refusal is encountered, no samples will be collected. Retained sediment samples will be analyzed for PCBs.

A summary of sampling activities for the former Monarch Mill property is described in Table 2-6. Installation and abandonment procedures for all borings are described in Appendix B.

2.5.5 King Street Storm Sewer

The area of the King Street Storm Sewer (Figure 19) to be investigated is proximal to the outfall of the storm sewer located between the northwest section of the King Highway Landfill and Riverview Park, and includes the floodplain soils adjacent to the inlet of the Kalamazoo River which receives the discharge from the storm sewer.

A total of eleven borings (Figure 19) will be installed following procedures contained in Appendix B. Eight of the borings (KSHB-1 through KSHB-4 and KSHB-8 through KSHB-11) will be installed along the western side of the inlet where no previous samples have been collected. These borings will be advanced to a depth of three feet or to the water table, whichever is less. Two samples from each boring KSHB-1 through KSHB-4 will be collected and analyzed for PCBs. The first sample will be obtained from the 0 to 6-inch interval below the surface, and the second sample will

be collected from the 0-to 6-inch interval below the top of the paper-making residuals layer. If no evidence of paper-making residuals are found, then the sample will be collected from 1.5 to 2.5 feet below the surface or the 1-foot interval above the water table, as conditions warrant. Borings KSHB-8 through KSHB-11 are to determine the extent of paper residuals on the western side. These borings will be visually inspected, but no chemical analysis will be performed on samples from these borings.

Boring KSHB-5 will be drilled to assess the potential contribution from the 48-inch circular culvert. Borings KSHB-6 and KSHB-7 will be drilled in the area on the eastern side where previous samples were collected. The data from these two borings will be compared to the previously collected data to assess if any changes have occurred since the 1989 sampling activities. Each of these three borings will be advanced to a depth of three feet or to the water table, whichever is less. Two samples from each boring will be analyzed for PCBs. The first sample will be collected from 0- to 6-inches below the surface and the second sample will be collected from 1.5 to 2.5 feet below the surface, or from two feet to the top of the water table, as conditions warrant. The deeper sample from KSHB-5 will also be analyzed for the CLP TCL/TAL constituents.

Sampling activities at King Street Storm Sewer are summarized in Table 2-7. Installation and abandonment procedures for all borings are described in Appendix B.

2.6 Stormwater Drainage Solids Sampling

2.6.1 Georgia-Pacific Corporation Kalamazoo Mill Property

An assessment of the mill's stormwater catchment area will be conducted to locate a representative sediment collection point along the path of stormwater flow. The sediment will be sampled following the split-spoon sampling procedures contained in Appendix B at this location and analyzed for PCBs, PCDDs, and PCDFs. This sample will be designated as GPD-1. The location of this sample will be submitted to the MDNR for their concurrence prior to sample collection. Also, a sample of solids will be collected from the former primary clarifier and analyzed for PCBs. This sample will be designated as GPC-1.

Sampling activities for the Georgia-Pacific Corporation Kalamazoo Mill are summarized in Table 2-2. The collection of samples will follow the procedures outlined in Appendix B.

2.6.2 Simpson Plainwell Paper Company Mill Property

A mill property drainage analysis will be performed to determine the overall catchment area and to locate a representative stormwater solids collection point. The exact location of the sample will be submitted to the MDNR for their concurrence once the drainage analysis is complete. A solids sample will be collected using a split-spoon sampler and identified as SPD-1. If a split-spoon method is not sufficient, then a thin-walled piston sampler or a coring device will be used. The solids will be analyzed for PCBs, PCDDs, and PCDFs. The significance of the results of the initial phase of stormwater solids sampling will be assessed and the assessment will be subject to MDNR's concurrence. Concentrations of

PCBs, PCDDs, or PCDFs (if any), the potential for off-site migration and the magnitude of potential loading, would be among the factors considered in the assessment. The sampling activities at Simpson Plainwell Paper Company Mill are summarized in Table 2-3.

A soil sample (0 to 6 inches) will be collected using a split-spoon sampler from the area of the former primary clarifier. A solids sample will be collected from the open drain which previously conveyed plant wastewater. These samples will be designated SPC-1 and SPC-2 (Figure 15) and will be analyzed for PCBs. One solids sample will be collected from the former secondary clarifier (SPC-3) and analyzed for PCBs.

A summary of activities for the Simpson Plainwell Paper Company Mill is found in Table 2-3. The collection of samples will follow the procedures in Appendix B.

2.6.3 Portage Paper Mill Property

To assess the stormwater runoff as a potential source of PCBs, PCDDs, and PCDFs to Portage Creek, the solids at the outfall east of Mill C will be sampled. The sample (PPC-1) will be analyzed for PCBs, PCDDs, and PCDFs. The significance of the results of the initial phase of stormwater solids sampling will be assessed and the assessment will be subject to MDNR's concurrence. Concentrations of PCBs, PCDDs, or PCDFs (if any), the potential for off-site migration and the magnitude of potential loading would be among the factors considered in the assessment.

If the pipe from former Mill A can be located, the solids from within the pipe will be analyzed for PCBs. This sample, to be designated PPC-2

will be collected using a stainless-steel scoop or spoon following the procedures in Appendix B.

To determine whether the mill wastewater conveyance system is a source of PCBs to the Kalamazoo River, the solids from the pump station south of Mill D (PPC-3) will be collected and analyzed for PCBs. The solids from the building area drainage system will be collected from the sump of the pump station and the Grey Tank, and analyzed for PCBs, PCDD, and PCDFs. These samples will be designated PPC-4 and PPC-5, respectively. The solids from the Bryant Clarifier will also be sampled (PPC-6) and analyzed for PCBs, PCDDs, and PCDFs.

A summary of sampling activities at the Portage Paper Mill property is found in Table 2-4. The collection of solids will follow the guidelines established in Appendix B.

2.6.4 Former King Mill Property

To assess the potential for surface runoff contribution of PCBs, PCDDs, and PCDFs to storm sewers, a site drainage analysis will be conducted at the former King Mill property. This drainage analysis will be performed to determine the overall catchment area and to locate a representative collection point. The solids at this point will be sampled as described in Appendix B and analyzed for PCBs, PCDDs, and PCDFs as required by MDNR. The location of the sample will be determined once the drainage analysis is complete. This sampling location, designated KMD-1, will be submitted to the MDNR for approval prior to sampling. The significance of the results of the initial phase of stormwater solids sampling will be assessed and the assessment will be subject to MDNR's concurrence.

An assessment of the 48-inch diameter pipe as a potential current source of PCBs to the Kalamazoo River will be conducted. Available historic information regarding the pipe, which apparently conveyed mill wastewater to the Kalamazoo River, will be developed to determine the existence of tributary pipes. The existing pipe will also be observed to determine whether it discharges during storm events. A sample of solids will be collected using a stainless-steel scoop or spoon from the effluent end of the pipe and analyzed for PCBs. This sample will be designated KMS-1.

A summary of the sampling activities for the former King Mill is found in Table 2-5. The protocol for collecting sediment and solids is in Appendix B.

2.7 Surface Water Sampling

Surface water samples from Portage Creek and the Kalamazoo River will be collected during both baseflow conditions and major runoff events to determine the transport of PCBs and possibly other constituents. Approximately 56 to 70 total base flow samples will be collected. Daily samples from three major rain events will also be collected. Samples will be collected using a DH-76 depth-integrated sampler (See Appendix C). A summary of surface-water sampling activities is contained in Table 2-8.

2.7.1 Base Flow Surface Water Sampling

Base flow surface water sampling locations on Portage Creek and the Kalamazoo River are as follows:

- Michigan Avenue on Portage Creek (Figure 4);

- Michigan Avenue on Kalamazoo River (Figure 4);
- River Street in Comstock, Michigan (Figure 4);
- D Avenue in Cooper Township (Figure 5);
- Farmer Street Downstream of Otsego Dam in Otsego, Michigan (Figure 7);
- Highway M-118 downstream of Allegan City Dam (Figure 9); and
- Highway 89 downstream of Lake Allegan Dam (Figure 11).

Six to eight rounds of baseflow samples will be collected from the above seven locations during the summer months and analyzed for PCBs and total suspended solids (TSS) with one round being analyzed for CLP TCL/TAL parameters. All surface water samples collected will require field measurements of temperature, pH, dissolved oxygen, conductivity, and turbidity. Field measurement procedures are found in Appendix D. Depth-integrated water-column sampling should begin in mid-June and be conducted on a biweekly bases until mid-September. A late autumn and late winter water sampling round will also be collected.

2.7.2 Event-based Surface Water Sampling

The event-based surface-water samples will be collected at:

- Michigan Avenue on Portage Creek in Kalamazoo (Figure 4);
- River Street in Comstock and Michigan Avenue in Kalamazoo, both upstream of the confluence (Figure 4);
- Farmer Street, downstream of the Otsego City Dam (Figure 7);
- Highway M-118 which is downstream of the Allegan City Dam (Figure 9); and

- Highway 89 downstream of Lake Allegan (Figure 11).

Approximately eight samples will be collected during each of the three runoff events at each location (with the exception of the location of Lake Allegan). Approximately four samples would be collected for analysis during the period of rising stage. As a practical matter, however, this sampling will possibly involve the collection of more than four samples during the period of rising stage for certain events. The selection of samples for analysis will be conducted after the peak discharge characteristics have been evaluated. At the Highway 89 location, two samples will be collected during each of three runoff events. The sampling intensity during runoff events is less than other sampling locations due to the expected dampening affect of Lake Allegan on streamflow, sediment transport, and water quality.

Surface-water samples will also be collected at Cork Street and Alcott Street on Portage Creek as part of the RI for the Allied Paper, Inc. OU. Collection of samples at the upstream Portage Creek location will be coordinated with sampling for the Kalamazoo River.

Depth-integrated samples will be collected following the procedures outlined in Appendix C. Surface-water samples will be analyzed for total PCBs and TSS. Field measurements for surface-water samples will include temperature, pH, dissolved oxygen, conductivity, and turbidity and will be performed as outlined in Appendix D. One event sample from each water sampling location will be analyzed for CLP TCL/TAL constituents.

2.7.3 In-stream Flow Measurements

The determination of a major runoff event will be made based on the flow at the Comstock gauging station which provides instantaneous stage

data via telephone. The Comstock gauging station will be contacted and precipitation conditions in Kalamazoo monitored daily to provide up-to-date flow and future weather conditions. A high flow event will be considered to begin when the flow exceeds 1,000 cubic feet per second (cfs) at the Comstock gauge for two consecutive days and the precipitation data indicates continuing increases. Within 24 hours of confirming high flow conditions a sampling team will be dispatched to collect samples. Each day the event-based locations will be sampled and will continue unless the change in daily flow is less than 100 cfs in which case the sampling frequency will be reduced to every two days or twice weekly. A total of six to eight samples will be analyzed from each location for each event distributed over the range of flow conditions.

Direct in-stream flow measurements will be made during each sampling event at two locations on the Kalamazoo River and one location on Portage Creek. The locations for direct in-stream measurement may be rotated each sampling period with reference elevations (such as "taping-down" from a fixed reference mark on a bridge) taken at every location. This would allow for the development of a preliminary stage discharge relationship for currently ungauged locations. The flows will be measured using an electro-magnetic velocity meter following the methods detailed in Appendix C.

2.8 Work Area Air Monitoring

Air sampling to be performed during the sampling activities at the mills will consist of work-area air monitoring (Appendix E). The work-area monitoring is intended to protect site workers. Field personnel will monitor volatile organic

compounds (VOCs) in certain situations as detailed in the Health and Safety Plan (HSP) by using a hand-held monitoring instrument (Appendix E). Action levels and levels of protection will be implemented as described in the HSP (Blasland & Bouck, 1993b).

2.9 Equipment Cleaning Procedures

The cleaning of field equipment will follow the procedures contained in Appendix F.

SECTION 3 - FIELD SAMPLING QUALITY ASSURANCE/ QUALITY CONTROL PROCEDURES

3.1 Introduction

This section discussed and defines the field QA/QC procedures to be used during implementation of the RI/FS Work Plan. These procedures will work in conjunction with the QA/QC procedures contained in the QAPP developed for the RI (Blasland & Bouck, 1993a).

3.2 Sample Handling

3.2.1 Sample Collection Precautions

Samples designated for CLP TCL/TAL analysis will require extra precautions when handling since volatile organic compounds (VOCs) are part of the constituents being analyzed. Samples must be introduced into containers gently, so as to minimize agitation which might enhance volatilization. Liquid will be poured into a container without producing air bubbles during filling (e.g., when sampling for volatile organic compounds (VOC), no air bubbles should exist in sample containers following collection). Samples will be re-collected if flow into container is turbulent and if bubbles are present. Samples to be analyzed for VOCs will be placed in a cool container to minimize volatilization. Sample containers will be stored in coolers with ice prior to use. Exposure of samples to the ambient air will be minimized by placing the samples in containers as soon as possible after collection.

No composite samples will be submitted for analysis of VOCs. This applies to all samples collected during the RI for VOC analysis. Presently, two types of composite samples for vertical integration are proposed for CLP TCL/TAL analysis (excluding VOCs):

- Composites of multiple samples collected at discrete depths; and
- Composites of continuous samples over a specific interval (e.g., 0 to 1-foot).

From a practical standpoint, both types of samples require homogenization in the field prior to dispensing aliquots to sample containers. To avoid inaccurate measurements of VOCs, which could result from sample homogenization, a different sample methodology will be used for VOCs; a relatively small aliquot from a discrete sample interval collected near the mid-depth of the total interval being composited, or from the middle of a continuous interval being composited, will be analyzed. These aliquots, without any homogenization, will be dispensed into the appropriate sample container, which will be sealed as quickly as possible.

Samples will not be collected or stored near running internal combustion engine or any type of exhaust system. Fumes from such devices could contaminate samples.

3.2.2 Sample Designation System

A concise and easily understandable sample designation system is an important part of the RI sampling activities. It provides a unique sample number that will facilitate both sample tracking and easy re-sampling of certain locations to evaluate temporal changes. The sample designation

system to be employed during the sampling activities will be consistent, yet flexible enough to accommodate unforeseen sampling events/conditions. A combination of letters and numbers will be used to yield a unique sample number for each field sampled collected. The sample designation system is described more fully in the Data Management Plan (Blasland & Bouck, 1993c).

3.2.3 Sample Containers and Preservation

The sample containerization, preservation, and handling procedures will follow standard protocols as described in the QAPP. The appropriate sample containers, preservation methods, holding times, and the analytical methods for the specific matrices are presented in Table 3-1. Preservation methods include the addition of parameter-specific chemical preservatives and refrigeration specific to the constituents being analyzed.

The analytical laboratory will supply appropriate containers for sample collection and preservation. The field sampling crew is responsible for properly collecting, labeling, and preserving the samples on ice (as needed) in coolers, immediately after collection. Sample containers will be labeled in accordance to procedures in Appendix G.

3.2.4 Sample Packing and Shipping Requirements

Sample packaging and shipping procedures are designed to ensure that the samples will arrive at the laboratory intact with the chain-of-custody (COC). Shipments will also contain matrix spike/matrix spike duplicate (MS/MSD) samples, trip and rinse blanks, and field duplicates as prescribed in Table 3-2.

Samples will be properly packaged for shipment as outlined in Appendix G and dispatched to the appropriate laboratory for analysis with a separate signed custody record enclosed in each sample box or cooler. Shipping containers will be secured with strapping tape and custody seals for shipment to the laboratory. The preferred procedure includes use of a custody seal attached to the front right and back left of the cooler. The custody seals are covered with clear plastic tape. The cooler is strapped shut with strapping tape in at least two locations. The samples will be packaged by designated personnel and transported as "environmental samples".

All shipments will be accompanied by a COC form identifying the contents. The original form will accompany the shipment; copies will be retained by the sampler for the sampling office records.

If the samples are sent by common carrier, a bill of lading should be used. Receipts of bills of lading will be retained as part of the permanent project documentation. If sent by mail, the package will be registered with return receipt requested. Commercial carriers are not required to sign off on the COC form as long as the COC forms are sealed inside the sample cooler and the custody seals remain intact. A hazardous waste manifest is not necessary since the samples are being transported to a laboratory for the purpose of testing (40 CFR 761.65(i)(2)(i)).

3.3 Documentation

Field personnel will provide comprehensive documentation covering all aspects of field sampling, field analysis, and COC. This documentation forms a record which will allow reconstruction of field events, thereby aiding the subsequent data review and interpretation process.

All documents, records, and information relating to the performance of the work at the Site will be retained. The forms of field documentation which will be maintained throughout the sampling activity are briefly outlined below.

3.3.1 Field Notebook

The field notebook will consist of a dedicated, bound, surveyor's-type notebook which will contain an overall record of all activities performed at the site, including, but not limited to:

- Project name and number;
- Sample locations;
- Sample descriptions;
- Sample dates;
- Weather conditions;
- Sampling times;
- Sample identification numbers;
- Sample collection methods;
- Sample handling (e.g., filtering) and preservation;
- Specific readings for site testing and sampling;
- Field instrument calibration/operation notes;
- Field measurement data;

- Samplers' names; and
- Any appropriate comments.

Data will be entered in ink with the date and signature of the individual responsible for data entry; blank pages will be noted as being intentionally blank.

The exact measurements from site testing and sampling will also be recorded on separate documentation sheets (e.g., subsurface logs). Separate documentation sheets are to be used to allow comprehensive documentation of daily site conditions by field personnel. These logs will be placed in a three-ring binder at the end of the day and numbered sequentially.

3.3.2 Geological Investigation Records

Subsurface logs and sediment sampling forms will be completed on-site. The subsurface logs will contain a record of information and description of the subsurface strata and geotechnical characteristics observed during drilling. Boring samples will be lithologically described using either the Burmister or the Unified Soil Classification Systems. Sediment samples will be lithologically described using the Unified Soil Classification System.

3.3.3 Water Sampling Records

Surface water field sampling records will be completed for each sample location and will contain water levels, physical appearance of the water, and field meter readings (temperature, pH, dissolved oxygen, turbidity, and specific conductance), where applicable. Water level readings will be

measured to surveyed reference points and recorded on a water level record.

Meters (temperature, pH, dissolved oxygen, turbidity, and specific conductance) will be calibrated daily in accordance with the manufacturer's recommendations. Standards, solutions used, concentrations, and readings taken will be recorded daily in field calibration logs (Appendix D).

3.3.4 Air Monitoring and Sampling Record

The photoionization detector (PID) will be calibrated as per the manufacturer's recommendations once after every 10 borings are field screened or daily (whichever occurs first). The PID calibration will be recorded on a field calibration log (Appendix E).

3.3.5 COC Forms

Completed COC forms will be required for all samples to be analyzed. COC forms will be initiated by the sampling crew in the field during the sample collection events. The COC forms will contain the sample's unique identification number, sample date and time, sample description, sample type, sample preservation (if any), and analyses required. The original COC form will accompany the samples to the laboratory and copies will be made prior to shipment (or multiple copy forms used) for separate field documentation. A COC form is included in Appendix G.

3.3.6 Field Reports

Field staff will prepare field reports to the RI/FS Project Coordinator and the Quality Assurance Manager (QAM). The content of the reports will include:

- Performance audit summaries including assessment of measurement data accuracy, precision, and completeness;
- Significant QA/QC problems and recommended solutions; and
- Resolutions of previously stated problems.

Field reports will be reviewed by the Field Sampling Coordinator prior to submittal to the File Custodian. The matrix of Project Personnel is provided in the Kalamazoo River/Portage Creek Superfund Site RI/FS Work Plan (Blasland & Bouck, 1993d).

3.4 Sample Custody

Any person obtaining custody of samples will be responsible for the care and custody of the samples. The term "custody" is defined below.

A person will have custody of samples when the samples are in their physical possession; their view after being in their physical possession; and their physical possession and secured so they cannot be tampered with. In addition, when samples are secured in a restricted area with access to authorized personnel only, the samples are deemed to be in the custody of such authorized personnel. COC forms will be completed for all samples to be analyzed as described in Section 3.3.5. The COC forms will remain with the samples at all times. The samples and signed chain-of-custody forms will remain in the possession of the sampling crew until the samples are delivered to the express carrier (e.g., Federal Express). The forms will then be placed in the project files in the Kalamazoo, Michigan project office.

3.5 Quality Control Samples

Sample types include: floodplain soil/sediment; in-river sediments; water column; ground water; soils, and residuals. Diligent adherence to all standard operating procedures described in this FSP is necessary to achieve a high degree of confidence in the data generated from the field samples. The rationale for QC samples is provided in the QAPP (Blasland & Bouck, 1993a).

The following types of field QC samples will be included for samples requiring analyses for CLP TCL/TAL constituents, PCDDs, PCDFs, and PCBs:

Field duplicates - two samples collected from the same location at the same time. Field duplicates will be used to assess environmental variability and laboratory performance. Field duplicate sample containers will be labeled as ordinary field samples with their own separate unique identification. The samples will not be identified as duplicates, thus the laboratory will analyze them as "blind" audit samples.

Rinse blanks - samples of distilled/deionized water which have been poured over sampling equipment after decontamination procedures have been performed. These samples will be used to evaluate the effectiveness of the cleaning procedures used.

Trip blanks - samples of distilled/deionized water which will be used to check for analytes introduced during shipping and handling of the samples prior to, during, and after sample collection. Samples to be analyzed for VOCs and metals will be accompanied by a trip blank.

The frequency of required field QC samples is summarized in Table 3-2.

3.6 Field Measurements

In order to maintain field precision and accuracy, all water quality meters and the PID will be calibrated to known standards recommended by the manufacturer. Field analysis and operation procedures, including calibration and sample analysis, are provided in Appendices D (thermometer, dissolved oxygen, turbidity, conductivity, and pH meters), and E (PID). Preventive maintenance procedures are also included in these appendices.

Temporally sensitive field data will be collected as quickly as possible in order to minimize errors associated with temporal variation.

3.7 Corrective Actions

Corrective actions include procedures to promptly investigate, document, evaluate, and correct any deficiencies in data quality. If a condition is noted to have an adverse effect on data quality, corrective action will be taken to avoid this condition. Condition identification, cause, and the corrective action implemented, will be documented and reported to the Blasland & Bouck RI/FS Project Coordinator and QAM. Implementation of corrective measure will be verified by documented follow-up action.

All project personnel have the responsibility, as part of their normal work duties, to promptly identify and report conditions adverse to data quality. Project personnel will, therefore, continuously monitor ongoing work performance in the normal course of daily responsibilities.

Examples of situations which would require corrective actions include, but are not limited to, the following:

- Protocols, as defined by the QAPP and FSP, have not been followed;
- Predetermined data acceptance standards are not obtained;
- Procedures have not been performed properly;
- Equipment is not properly calibrated, or is not functioning correctly;
- Sample and test results are not completely traceable;
- QC requirements have not been met;
- Improper approvals; or
- Concerns resulting from system or performance audits are identified.

Corrective actions will be documented on a Corrective Action Request Form, as identified in the QAPP.

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Acronyms and Abbreviations

ACRONYMS AND ABBREVIATIONS

AOC	Administrative Order by Consent
ASTM	American Society for Testing and Materials
Blasland & Bouck	Blasland & Bouck Engineers, P.C.
cfs	Cubic Feet Per Second
CFR	Code of Federal Regulations
CLP TCL/TAL	Contract Laboratory Program Target Compound List/Target Analyte List
Cs-137	Cesium-137
COC	Chain-of-Custody
DCS	Description of the Current Situation
EA	Endangerment Assessment
FS	Feasibility Study
FSP	Field Sampling Plan
HSP	Health & Safety Plan
IP	Ionization Potential
KRSG	Kalamazoo River Study Group
MDNR	Michigan Department of Natural Resources
mg/kg	Milligrams per Kilogram
MS/MSD	Matrix Spike/Matrix Spike Duplicate
MSB	Matrix Spike Bland
NIST	National Institute of Standards and Technology
NTU	Nephelometric Turbidity Units
OU	Operable Unit
PCBs	Polychlorinated biphenyls
PCDDs	Polychlorinated dibenzo-p-dioxins
PCDFs	Polychlorinated dibenzofurans
PID	Photoionization Detector
ppm	parts per million
QAM	Quality Assurance Manager
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
Site	Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site and Additional RI/FS Areas
SOW	Statement of Work
TOC	Total Organic Carbon
TSS	Total Suspended Solids
ug/l	Micrograms per Liter
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VTSR	Validated Time of Sample Receipt
UV	Ultraviolet
VOC	Volatile Organic Compound

Tables

TABLE 2-1

Allied Paper, Inc./Portage Creek/Kalamazoo River
Superfund Site

RI/FS Field Sampling Plan

RI Samples - Sediment and Floodplain Soils Investigation

Study Activity	Sample Media	Sample Location[1]	Type of Analysis[2]	No. of Sampling Points	No. of Samples	RI Data Collection Objectives[3]
In-Stream Sediment Probing and Characterization	river/creek sediment	Portage Creek Alcott Street to Confluence	• sediment depth • lithology description • position/elevation • visual reconnaissance of river • velocity (20 to 25% of transects) • upper 4' retained for possible future analysis	15 transects	---	5
		Segment 1		54 transects	---	
		Segment 2		12 transects	---	
		Segment 3		12 transects	---	
		Segment 4		15 transects	---	
		Segment 5		15 transects	---	
		Segment 6		17 transects	---	
		Segment 7		15 transects	---	
		Segment 8		19 transects	---	
		Segment 9		12 transects	---	

(See Notes on Page 9)

TABLE 2-1
(cont'd)

Allied Paper, Inc./Portage Creek/Kalamazoo River
Superfund Site

RI/FS Field Sampling Plan

RI Samples - Sediment and Floodplain Soils Investigation

Study Activity	Sample Media	Sample Location[1]	Type of Analysis[2]	No. of Sampling Points	No. of Samples	RI Data Collection Objectives[3]
Geostatistical Pilot Study	river sediment	1-mile stretch between Otsego Dam and Trowbridge Dam	• PCBs • sediment depth • lithology description • position/elevation	62	124	2
Exposed Former Impoundment Sediment Sampling	soil/sediment	Former Plainwell Impoundment	• PCBs • lithology description • position/elevation	6 transects with 5 cores each	120	1,2,3,4,5,6
			• TOC		60	
			• CLP TCL/TAL	1 core	2	
			• Physical characterization[5]	3 cores	18	
		Former Otsego Impoundment	• PCBs • lithology description • position/elevation	6 transects with 5 cores each	120	
			• TOC	1 core	60	
			• CLP TCL/TAL	1 core	2	
			• Physical characterization[5]	3 cores	18	

(See Notes on Page 9)

TABLE 2-1
(cont'd)

Allied Paper, Inc./Portage Creek/Kalamazoo River
Superfund Site

RI/FS Field Sampling Plan

RI Samples - Sediment and Floodplain Soils Investigation

Study Activity	Sample Media	Sample Location[1]	Type of Analysis[2]	No. of Sampling Points	No. of Samples	RI Data Collection Objectives[3]
Exposed Former Impoundment Sediment Sampling (cont'd)	soil/sediment (cont'd)	Former Trowbridge Impoundment	• PCBs • lithology description • position/elevation	9 transects with 8 points each	288	1,2,3,4,5,6
			• TOC		144	
			• CLP TCL/TAL	1 core	2	
			• Physical characterization[6]	3 cores	18	
Floodplain Soil Sampling	soils	Upjohn Park (adjacent to Portage Creek)	• PCBs • lithology description • position/elevation	1 transect with 5 points	10	2,6
			• TOC		5	
		Portage Paper Mill Property (adjacent to Portage Creek)	• PCBs • lithology description • position/elevation	5 random locations	10	
			• TOC		5	

(See Notes on Page 9)

TABLE 2-1
(cont'd)

Allied Paper, Inc./Portage Creek/Kalamazoo River
Superfund Site

RI/FS Field Sampling Plan

RI Samples - Sediment and Floodplain Soils Investigation

Study Activity	Sample Media	Sample Location[1]	Type of Analysis[2]	No. of Sampling Points	No. of Samples	RI Data Collection Objectives[3]
Floodplain Soil Sampling (cont'd)	soils (cont'd)	Verburg Park	• PCBs • lithology description • position/elevation	1 transect with 8 points	18	2,6
			• TOC		8	
			• CLP TCL/TAL	1 core	2	
		South of D Avenue	• PCBs • lithology description • position/elevation	1 transect with 8 cores	18	
			• TOC		8	
			• CLP/TCL/TAL	1 core	2	
		Brookside Park	• PCBs • lithology description • position/elevation	1 transect with 8 cores	18	
			• TOC		8	
			• CLP TCL/TAL	1 core	2	

(See Notes on Page 9)

TABLE 2-1
(cont'd)

Allied Paper, Inc./Portage Creek/Kalamazoo River
Superfund Site

RI/FS Field Sampling Plan

RI Samples - Sediment and Floodplain Soils Investigation

Study Activity	Sample Media	Sample Location[1]	Type of Analysis[2]	No. of Sampling Points	No. of Samples	RI Data Collection Objectives[3]
Floodplain Soil Sampling (cont'd)	soils (cont'd)	Former Otsego Dam Impoundment	• PCBs • lithology description • position/elevation	1 transect with 8 cores	18	2,6
			• TOC		8	
			• CLP TCL/TAL	1 core	2	
		Downstream of Trowbridge Dam	• PCBs • lithology description • position/elevation	1 transect with 8 cores	18	
			• TOC		8	
			• CLP TCL/TAL	1 core	2	
		Koopman Marsh/ Swan Creek Marsh	• PCBs • lithology description • position/elevation	3 transects with 5 cores	45	
			• TOC		15	
		Ottawa Marsh	• PCBs	3 cores	14	
			• CLP TCL/TAL		1	
		Pottowatamie Marsh	• PCBs	3 cores	14	
			• CLP TCL/TAL		1	

(See Notes on Page 9)

TABLE 2-1
(cont'd)

Allied Paper, Inc./Portage Creek/Kalamazoo River
Superfund Site

RI/FS Field Sampling Plan

RI Samples - Sediment and Floodplain Soils Investigation

Study Activity	Sample Media	Sample Location[1]	Type of Analysis[2]	No. of Sampling Points	No. of Samples	RI Data Collection Objectives[3]
Endangerment Assessment Soil Sampling[4]	soils	Ft. Custer State Recreation Area	• PCBs	3 6-sample composites	3	6
		Former Plainwell Dam Impoundment	• PCBs	6 6-sample composites	6	
		Downstream of Plainwell Dam	• PCBs	3 6-sample composites	3	
		Pine Creek Impoundment	• PCBs	3 6-sample composites	3	

(See Notes on Page 9)

TABLE 2-1
(cont'd)

Allied Paper, Inc./Portage Creek/Kalamazoo River
Superfund Site

RI/FS Field Sampling Plan

RI Samples - Sediment and Floodplain Soils Investigation

Study Activity	Sample Media	Sample Location[1]	Type of Analysis[2]	No. of Sampling Points	No. of Samples	RI Data Collection Objectives[3]
EA Soil Sampling (cont'd)	soils (cont'd)	Former Otsego Dam Impoundment	• PCBs	6 6-sample composites	6	6
		Former Trowbridge Dam Impoundment	• PCBs	12 6-sample composites	12	
		Koopman Marsh	• PCBs	3 6-sample composites	3	
Geochronological Dating Sampling[5]	lake sediments	Allegan City Dam Impoundment	• Cs-137 • lithology description • position/elevation	2 cores	12	2,3,5,6
		Kalamazoo Lake	• Cs-137 • lithology description • position/elevation	2 cores	12	
Source Identification	river sediments	Tributary to Morrow Lake	• PCBs • TOC (0-6") • lithology description • sediment depth • water depth • position	1	6	2,4
		Segment 1		8	48	
		Segment 2		1	6	
		Segment 3		1	6	
		Segment 4		2	12	
		Segment 5		1	6	

(See Notes on Page 9)

TABLE 2-1
(cont'd)

Allied Paper, Inc./Portage Creek/Kalamazoo River
Superfund Site

RI/FS Field Sampling Plan

RI Samples - Sediment and Floodplain Soils Investigation

Study Activity	Sample Media	Sample Location[1]	Type of Analysis[2]	No. of Sampling Points	No. of Samples	RI Data Collection Objectives[3]
Source Identification (cont'd)	river sediments (cont'd)	Segment 6	• PCBs • TOC (0-6") • lithology description • sediment depth • water depth • position	1	6	2,4
		Segment 8		1	6	

(See Notes on Page 9)

TABLE 2-1
(cont'd)

Allied Paper, Inc./Portage Creek/Kalamazoo River
Superfund Site

RI/FS Field Sampling Plan

RI Samples - Sediment and Floodplain Soils Investigation

Notes:

[1]Kalamazoo River Segments:

Segment 1 = Morrow Lake Dam to Main Street Plainwell
Segment 2 = Main Street Plainwell to Plainwell Dam
Segment 3 = Plainwell Dam to Otsego City Dam
Segment 4 = Otsego City Dam to Otsego Dam
Segment 5 = Otsego Dam to Trowbridge Dam
Segment 6 = Trowbridge Dam to Allegan City Line
Segment 7 = Allegan City Line to Allegan City Dam
Segment 8 = Allegan City Dam to Lake Allegan Dam
Segment 9 = Lake Allegan Dam to Lake Michigan

[2]Abbreviations used in this table:

PCBs	= Polychlorinated biphenyls
CLP TCL/TAL	= Contract Laboratory Program Target Compound List/Target Analyte List
TOC	= Total organic carbon
Cs-137	= Cesium-137

TABLE 2-1
(cont'd)

Allied Paper, Inc./Portage Creek/Kalamazoo River
Superfund Site

RI/FS Field Sampling Plan

RI Samples - Sediment and Floodplain Soils Investigation

Notes (Cont'd.)

[3]RI Data Collection Objectives:

1. Characterize chemical nature of wastes at the site.
2. Determine the spatial distribution of chemicals.
3. Identify chemical migration pathways and movement.
4. Identify sources.
5. Support the evaluation of remedial alternatives.
   a. Assess the technical feasibility of an alternative (e.g., material characteristics).
   b. Assess the effectiveness of potential alternatives (i.e., information enabling the prediction of how the system would respond).
6. Assess exposure to chemicals (i.e., support the risk assessment).

[4]Initial screening of candidate Terrestrial Biological Study Areas.

[5]Phase I of Geochronological Dating only.

TABLE 2-2

Allied Paper, Inc./Portage Creek/Kalamazoo River
Superfund Site

RI/FS Field Sampling Plan

RI Samples - Georgia-Pacific Corporation Kalamazoo Mill Property Investigation

Location	Sample ID	Media	Number of Samples	Depth Intervals[1]	Parameter(s)[2]	RI Data Collection Obj.[3]
Stormwater Solids	GPD-1	solids	1	• 0 - 6"	PCBs, PCDDs, PCDFs	1,2,3,4
Former Primary Clarifier	GPC-1	solids	1	• 0 - 6"	PCBs	1,2,4
Three Former Lagoons (NW of Mill)	GPL-1 to GPL-3	soil/ residuals	6	• 0 - 6"; • Native soil 0.5' to 2.5' below base of residuals[4]	PCBs	1,2,4
Two Former Lagoons (near primary clarifier)	GPL-4 and GPL-5	soil/ residuals	6	• 0-6"; • Native soil 0.5' to 2.5' below base of residual[4]	PCBs	1,2,4
	GPL-6 and GPL-7	soil/ residuals	0	• to 2.5' below base of residuals[4]	None (visual only)	2

(See Notes on Page 2)

TABLE 2-2
(cont'd)

Allied Paper, Inc./Portage Creek/Kalamazoo River
Superfund Site

RI/FS Field Sampling Plan

RI Samples - Georgia-Pacific Corporation Kalamazoo Mill Property Investigation

Notes:

[1]Soil samples will be composited for each depth interval sampled.

[2]Abbreviations used in this table:

PCBs	=	Polychlorinated biphenyls
PCDDs	=	Polychlorinated dibenzo-p-dioxins
PCDFs	=	Polychlorinated dibenzofurans

[3]RI Data Collection Objectives:

1. Characterize chemical nature of wastes at the site.
2. Determine the spatial distribution of chemicals.
3. Identify chemical migration pathways and movement.
4. Identify sources.

[4]If an identifiable interface is observed between the base to the residuals and native soil, the native soil sample interval may be modified to allow collection of a representative sample of the native soil below the interface. The specific location will be identified in the field.

TABLE 2-3

Allied Paper, Inc./Portage Creek/Kalamazoo River
Superfund Site

RI/FS Field Sampling Plan

RI Samples - Simpson Plainwell Paper Company Mill Property Investigation

Location	Sample ID	Media	Number of Samples	Depth Intervals[1]	Parameter(s)[2]	RI Data Collection Obj.[3]
Stormwater Solids	SPD-1	solids	1	• 0-6"	PCBs, PCDDs, PCDFs	1,2,3,4
Former Primary Clarifier	SPC-1	solids	1	• 0-6"	PCBs	1,2,4
Open Drain	SPC-2	solids	1	• 0-6"	PCBs	1,2,4
Former Secondary Clarifier	SPC-3	solids	1	• 0-6"	PCBs	1,2,4
Former Lagoons	SPL-1 to SPL-5	soil/ residuals	15	• 0-6" • 0.5' to 1.5' above base of residuals if residual <5' deep • 0.5' to 2.5' below base of residuals[4]	PCBs	1,2,4
Former Aeration Basin	SPL-6	soil/ residuals	2	• 0-6" • Native soil 0.5' to 2.5' below base of residuals[4]	PCBs	1,2,4
Former Lagoons	SPL-7 to SPL-13	soil/ residuals	0	• to 2.5' below base of residuals[4]	None (visual only)	2

(See Notes on Page 2)

TABLE 2-3
(cont'd)

Allied Paper, Inc./Portage Creek/Kalamazoo River
Superfund Site

RI/FS Field Sampling Plan

RI Samples - Simpson Plainwell Paper Company Mill Property Investigation

Notes:

[1]Soil samples will be composited for each depth interval sampled.

[2]Abbreviations used in this table:

PCBs	=	Polychlorinated biphenyls
PCDDs	=	Polychlorinated dibenzo-p-dioxins
PCDFs	=	Polychlorinated dibenzofurans

[3]RI Data Collection Objectives:

1. Characterize chemical nature of wastes at the site.
2. Determine the spatial distribution of chemicals.
3. Identify chemical migration pathways and movement.
4. Identify sources.

[4]If an identifiable interface is observed between the base to the residuals and native soil, the native soil sample interval may be modified to allow collection of a representative sample of the native soil below the interface. The specific location will be identified in the field.

TABLE 2-4

Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site

RI/FS Field Sampling Plan

RI Samples - Portage Paper Mill Property Investigation

Location	Sample ID	Media	Number of Samples	Depth Intervals[1]	Parameter(s)[2]	RI Data Collection Obj.[3]
Stormwater Outfall	PPC-1	solids	1	0-6"	PCBs, PCDDs, PCDFs	1,2,3,4
Mill A Pipe[4]	PPC-2	solids	1	0-6"	PCBs	1,2,3,4
Pump Station Mill D	PPC-3	solids	1	0-6"	PCBs	1,2,4
Sump	PPC-4	solids	1	0-6"	PCBs	1,2,3,4
Grey Tank	PPC-5	solids	1	0-6"	PCBs	1,2,3,4
Bryant Clarifier	PPC-6	solids	1	0-6"	PCBs	1,2,3,4

Notes

[1]Soil samples will be composited for each depth interval sampled.

[2]Abbreviations used in this table:

PCBs = Polychlorinated biphenyls
PCDDs = Polychlorinated dibenzo-p-dioxins
PCDFs = Polychlorinated dibenzofurans

[3]RI Data Collection Objectives:

1. Characterize chemical nature of wastes at the site.
2. Determine the spatial distribution of chemicals.
3. Identify chemical migration pathways and movement.
4. Identify sources.

[4]Mill A pipe may not be locatable.

TABLE 2-5

Allied Paper, Inc./Portage Creek/Kalamazoo River
Superfund Site

RI/FS Field Sampling Plan

RI Samples - Former King Mill Property Investigation

Location	Sample ID	Media	Number of Samples	Depth Intervals[1]	Parameter(s)[2]	RI Data Collection Obj.[3]
Drainage	KMD-1	soil	1	• 0-6"	PCBs	1,2,3,4
Storm Sewer (48")	KMS-1	sediment	1	• 0-6"	PCBs	1,2,3,4
Former Clarifiers	KM-1 and KM-2	sediment	4	• 0-6" • 2-4'	PCBs	1,2,4
Former N-S Lagoon	KM-3 and KM-5	soil/residuals	0	• to 2.5' below base of residuals[4]	None (visual only)	2
Former N-S Lagoon	KM-4	soil/residuals	3	• 0-6" • 0.5' to 1.5' above base of residuals • 0.5' to 2.5' below base of residuals[4]	PCBs	1,2,4
Former NE Lagoon	KM-6 and KM-8	soil/residuals	0	• to 2.5' below base of residuals[4]	None (visual only)	2
Former NE Lagoon	KM-7	soil/residuals	3	• 0-6" • 0.5' to 1.5' above base of residuals • 0.5' to 2.5' below base of residuals[4]	PCBs	1,2,4

(See Notes on Page 2)

TABLE 2-5
(cont'd)

Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site

RI/FS Field Sampling Plan

RI Samples - Former King Mill Property Investigation

Notes:

[1]Soil samples will be homogenized for each depth interval sampled.

[2]Abbreviations used in this table:

PCBs = Polychlorinated biphenyls

[3]RI Data Collection Objectives:

1. Characterize chemical nature of wastes at the site.
2. Determine the spatial distribution of chemicals.
3. Identify chemical migration pathways and movement.
4. Identify sources.

[4]If an identifiable interface is observed between the base to the residuals and native soil, the native soil sample interval may be modified to allow collection of a representative sample of the native soil below the interface. The specific location will be identified in the field.

TABLE 2-6

Allied Paper, Inc./Portage Creek/Kalamazoo River
Superfund Site

RI/FS Field Sampling Plan

RI Samples - Former Monarch Mill Property Investigation

Location	Sample ID	Media	Number of Samples	Depth Intervals[1]	Parameter(s)[2]	RI Data Collection Obj.[3]
Former Mill Race Discharge	MM-1	sediment	1	See Note[1]	PCBs	1,2,3,4
Former Mill Race Discharge	MM-2	sediment	1	See Note[1]	PCBs	1,2,3,4

Notes:

[1]Soil samples will be homogenized for each depth interval sampled. Actual depth will be determined in the field to a maximum of 15 feet. If auger refusal is encountered (i.e., due to buried pipe), boreholes will be abandoned and no samples will be collected.

[2]Abbreviations used in this table:

PCBs = Polychlorinated biphenyls

[3]RI Data Collection Objectives:

1. Characterize chemical nature of mill race sediments at the site.
2. Determine the spatial distribution of chemicals.
3. Identify chemical migration pathways and movement.
4. Identify sources.

TABLE 2-7

Allied Paper, Inc./Portage Creek/Kalamazoo River
Superfund Site

RI/FS Field Sampling Plan

RI Samples - King Street Storm Sewer Investigation

Location	Sample ID	Media	Number of Samples	Depth Intervals[1]	Parameter(s)[2]	RI Data Collection Obj.[3]
Western Side	KSHB-1 to KSHB-4	soil	8	• 0-6" • 1.5' - 2.5'	PCBs	1,2,3,4
Culvert	KSHB-5	sediment	2	• 0-6" • 1.5' - 2.5'	PCBs, CLP TCL/TAL (lower only)	1,2,3,4
Eastern Side	KSHB-6 and KSHB-7	soil	4	• 0-6" • 1.5' - 2.5'	PCBs	1,2,3,4
Western Side	KSHB-8 to KSHB-11	soil	0	• 0-3'	none (visual only)	2

Notes:

[1]Soil samples will be homogenized for each depth interval sampled.

[2]Abbreviations used in this table:

PCBs = Polychlorinated biphenyls
CLP TCL/TAL = Contract Laboratory Program Target Compound List/Target Analyte List

[3]RI Data Collection Objectives:

1. Characterize chemical nature of wastes at the site.
2. Determine the spatial distribution of chemicals.
3. Identify chemical migration pathways and movement.
4. Identify sources.

TABLE 2-8
Allied Paper, Inc./Portage Creek/Kalamazoo River
Superfund Site

RI/FS Field Sampling Plan

RI Samples - Surface Water Investigation

Study Activity	Sample Media	Sampling Location	Type of Analysis[1]	No. of Samples	RI Data Collection Objectives[2]
Event-Specific Sampling	surface water	Portage Creek-Michigan Avenue	• PCBs • TSS • field parameters[3]	24	1,3,4,6
			• CLP TCL/TAL	1	
		Kalamazoo River-River Street	• PCBs • TSS • field parameters	24	
			• CLP TCL/TAL	1	
		Kalamazoo River-Michigan Avenue	• PCBs • TSS • field parameters	24	
			• CLP TCL/TAL	1	
		Kalamazoo River - Farmer Street downstream of Otsego City Dam	• PCBs • TSS • field parameters	24	
			• CLP TCL/TAL	1	

(See Notes on Page 4)

TABLE 2-8
(Cont'd)
Allied Paper, Inc./Portage Creek/Kalamazoo River
Superfund Site

RI/FS Field Sampling Plan

Remedial Investigation Samples - Surface Water Investigation

Study Activity	Sample Media	Sampling Location	Type of Analysis[1]	No. of Samples	RI Data Collection Objectives[2]
Event-Specific Sampling (cont'd.)	surface water (cont'd.)	Kalamazoo River-Highway M-118	• PCBs • TSS • field parameters	24	1,3,4,6
			• CLP TCL/TAL	1	
		Kalamazoo River- Highway 89 below Lake Allegan Dam	• PCBs • TSS • field parameters	6	
			• CLP TCL/TAL	1	
Base-Flow Sampling	surface water	Portage Creek-Michigan Avenue	• PCBs • TSS • field parameters	8-10	1,2,3,4,5,6
			• CLP TCL/TAL	1	
		Kalamazoo River-River Steet	• PCBs • TSS • field parameters	8-10	
			• CLP TCL/TAL	1	

(See Notes on Page 4)

TABLE 2-8
(Cont'd)
Allied Paper, Inc./Portage Creek/Kalamazoo River
Superfund Site

RI/FS Field Sampling Plan

Remedial Investigation Samples - Surface Water Investigation

Study Activity	Sample Media	Sampling Location	Type of Analysis[1]	No. of Samples	RI Data Collection Objectives[2]
Base-Flow Sampling (cont'd)	surface water (cont'd)	Kalamazoo River-Michigan Avenue	• PCBs • TSS • field parameters	8-10	1,2,3,4,5,6
			• CLP TCL/TAL	1	
		Kalamazoo River-D Avenue	• PCBs • TSS • field parameters	8-10	
			• CLP TCL/TAL	1	
		Kalamazoo River-Farmer Street downstream of Otsego City Dam	• PCBs • TSS • field parameters	8-10	
			• CLP TCL/TAL	1	
		Kalamazoo River-Highway M-118	• PCBs • TSS • field parameters	8-10	
			• CLP TCL/TAL	1	
		Kalamazoo River-Highway 89 below Lake Allegan Dam	• PCBs • TSS • field parameters	8-10	1,2,3,4,5,6
			• CLP TCL/TAL	1	

(See Notes on Page 4)

TABLE 2-8
(Cont'd)
Allied Paper, Inc./Portage Creek/Kalamazoo River
Superfund Site

RI/FS Field Sampling Plan

Remedial Investigation Samples - Surface Water Investigation

Notes:

[1]Abbreviations used in this table:

PCBs	=	Polychlorinated biphenyls
CLP TCL/TAL	=	Contract Laboratory Program Target Compound List/Target Analyte List
TSS	=	Total Suspended Solids

[2]RI Data Collection Objectives:

1. Characterize chemical nature of wastes at the site.
2. Determine the spatial distribution of chemicals.
3. Identify chemical migration pathways and movement.
4. Identify sources.
5. Support the evaluation of remedial alternatives.
   a. Assess the technical feasibility of an alternative (e.g., material characteristics).
   b. Assess the effectiveness of potential alternatives (i.e., information enabling the prediction of how the system would respond).
6. Assess exposure to chemicals (i.e., support the risk assessment).

[3]Field Parameters include:
flow, temperature, pH, dissolved oxygen, conductivity, turbidity

Table 3-1

Allied Paper, Inc./Portage Creek/Kalamazoo River
Superfund Site

RI/FS Field Sampling Plan

Required Containers, Preservation Techniques, and Holding Times

Water Samples*					
Parameter	Reference	Sample Container	Sample Volume	Preservation	Maximum Holding Time**
Volatile Organics	CLP SOW, Organics[5]	two 40-ml glass vials with Teflon-lined septum cap	80 ml	no head space, 4 drops concentrated HCl, cool, 4°C	10 days of VTSR
Semi-Volatile Organics	CLP SOW, Organics[5]	amber glass with Teflon-lined cap	1 liter	cool, 4°C	extract within 5 days of VTSR, analyze within 40 days following the start of extraction
Pesticides/PCBs	CLP SOW, Organics[5]	amber glass with Teflon-lined cap	1 liter	cool, 4°C	extract within 5 days of VTSR, analyze within 40 days following the start of extraction
PCBs Only	USEPA, Method 8081[4] (modified for PCBs only)	amber glass with Teflon-lined cap	1 liter	cool, 4°C	extract within 5 days of VTSR, analyze within 40 days following the start of extraction
Metals*-except Mercury	CLP SOW, Inorganics[6]	polyethylene or glass	1 liter	adjust to pH<2 with HNO_3	180 days of VTSR
Mercury*	CLP SOW, Inorganics[6]	polyethylene or glass	analyze from metals bottle	adjust to pH <2 with HNO_3	26 days of VTSR
Cyanide	CLP SOW, Inorganics[6]	polyethylene or glass	1 liter	adjust to pH >12 with NaOH cool, 4°C	12 days of VTSR
TSS	160.2[2]	polyethylene or glass	100 ml	cool, 4°C	7 days of collection
Alkalinity	310.1[2]	plastic or glass	100 ml	cool, 4°C	14 days of collection
Chemical Oxygen Demand	410.1[2]	plastic or glass	50 ml	cool, 4°C H_2SO_4 to pH<2	28 days of collection
Chloride	325.2[2]	plastic or glass	50 ml	None required	28 days of collection
Sulfate	375.2[2]	plastic or glass	50 ml	cool, 4°C	28 days of collection
pH	150.1[2]	plastic or glass	25 ml	None required	Analyze immediately
Conductance	120.1[2]	plastic or glass	100 ml	cool, 4°C	28 days of collection
Nitrate	353.2[2]	plastic or glass	100 ml	cool, 4°C, H_2SO_4 to pH<2	28 days of collection
Turbidity	180.1[2]	plastic or glass	100 ml	cool, 4°C	48 hours of collection

(see notes on page 3)

Table 3-1
(Cont'd)
Allied Paper, Inc./Portage Creek/Kalamazoo River
Superfund Site

RI/FS Field Sampling Plan

Required Containers, Preservation Techniques, and Holding Times

Soil, Sediment, and Paper-Making Residual Samples					
Parameter	Reference	Sample Container	Sample Volume	Preservation	Maximum Holding Time**
Volatile Organics	CLP SOW, Organics[5]	two 40 ml glass vials with Teflon-lined septum cap	80 ml	no head space, cool, 4°C	10 days of VTSR
Semi-Volatile Organics	CLP SOW, Organics[5]	widemouth glass jar, with Teflon-lined lid	250 ml	cool, 4°C	extract within 10 days of VTSR, analyze within 40 days following start of extraction
Pesticides/PCBs	CLP SOW, Organics[5]	widemouth glass jar, with Teflon-lined lid	analyze from semi-volatile jar	cool, 4°C	extract within 10 days of VTSR, analyze within 40 days following start of extraction
PCBs Only	USEPA, Method 8081[4] (modified for PCBs only)	widemouth amber glass jar, with Teflon-lined lid	250 ml	cool, 4°C	extract within 10 days of VTSR, analyze within 40 days following start of extraction
PCDDs/PCDFs	SW-846 Method 8290[4]	widemouth amber glass jar, with Teflon-lined lid.	125 ml	cool, 4°C protect from light	extract within 30 days of collection, analyze within 45 days following collection
Metals-except Mercury	CLP SOW, Inorganics[6]	widemouth polyethylene or glass jar	500 ml	cool, 4°C	180 days of VTSR
Mercury	CLP SOW, Inorganics[6]	widemouth polyethylene or glass jar	analyze from metals jar	cool, 4°C	26 days of VTSR
Cyanide	CLP SOW, Inorganics[6]	widemouth polyethylene or glass jar	analyze from metals jar	cool, 4°C	12 days of VTSR
One-Dimensional Consolidation	ASTM, D2435[1]	Shelby tube	minimum diameter 50 mm, minimum height 12mm, minimum diameter-to-height ratio - 2.5	none	not specified
Atterberg Limits	ASTM, D4318[1]	glass or plastic	500g	none	not specified
Laboratory Permeability	ASTM, D5084[1]	Shelby tube	minimum diameter 25 mm, minimum height 25mm	none	not specified
Particle Size Distribution	ASTM, D422[1]	glass or plastic	5,000g	none	not specified
Total Organic Carbon	Lloyd Kahn, USEPA[3]	widemouth polyethylene or glass jar	100g	cool, 4°C	28 days from collection

(see notes on page 3)

Table 3-1
(Cont'd)
Allied Paper, Inc./Portage Creek/Kalamazoo River
Superfund Site

RI/FS Field Sampling Plan

Required Containers, Preservation Techniques, and Holding Times

Notes:

CLP SOW	= Contract Laboratory Program Statement of Work.
VTSR	= Validated time of sample receipt: laboratory will receive samples within 48 hours of sample collection
*	= Groundwater samples to be analyzed for dissolved metals will be field filtered prior to the addition of preservatives.
**	= Holding times for samples which have been frozen are measured from date of thawing.
NA	= Not applicable.
HCl	= Hydrochloric acid.
HNO_3	= Nitric acid.
NaOH	= Sodium Hydroxide.
H_2SO_4	= Sulfuric acid.

References:

[1]ASTM, 1993.
[2]USEPA, 1983.
[3]USEPA, 1986.
[4]USEPA, 1990.
[5]USEPA, 1991a.
[6]USEPA, 1991b.

TABLE 3-2

Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site

RI/FS Field Sampling Plan

Required Field and Laboratory Quality Control Analysis

Environmental Sample Matrix/ Laboratory Parameters	Field QC Analyses			Laboratory QC Analyses			
	Trip Blank[1]	Field Dup.	Rinse Blank	MS	MSD	MSB	Lab Dup.
	Freq.	Freq.	Freq.	Freq.	Freq.	Freq.	Freq.
SURFACE WATER							
PCBs (total)	--	1/10	1/10	1/20	1/20	1/20	--
CLP TCL	1/D	1/10	1/10	1/20	1/20	--	--
CLP TAL	1/D	1/10	--	--	--	--	--
Total Suspended Solids	--	1/10	--	--	--	--	--
pH	--	1/10	--	--	--	--	--
Specific conductance	--	1/10	--	--	--	--	--

(See Notes on Page 3)

TABLE 3-2
(cont'd)

Allied Paper, Inc./Portage Creek/Kalamazoo River
Superfund Site

RI/FS Field Sampling Plan

Required Field and Laboratory Quality Control Analysis

Environmental Sample Matrix/ Laboratory Parameters	Field QC Analyses			Laboratory QC Analyses			
	Trip Blank[1]	Field Dup.	Rinse Blank	MS	MSD	MSB	Lab Dup.
	Freq.	Freq.	Freq.	Freq.	Freq.	Freq.	Freq.
SOIL/SEDIMENT/PAPER-MAKING RESIDUALS							
PCBs	--	1/10	1/10	1/20	1/20	1/20	--
CLP TCL	--	1/10	1/10	1/20	1/20	--	--
CLP TAL	--	1/10	1/10	1/20	--	--	1/20
PCDDs/PCDFs	--	1/10	1/10	1/20	1/20	--	--
Total Organic Carbon	--	1/10	1/10	1/20	--	--	--
Radioisotope Analysis	--	1/10	--	--	--	--	--

(See Notes on Page 3)

TABLE 3-2
(cont'd)

Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site

RI/FS Field Sampling Plan

Required Field and Laboratory Quality Control Analysis

Notes:
[1]Trip blanks are analyzed for volatile and inorganic constituents only
1/D - One trip blank per day of sample collection, analyzed for volatiles and inorganics only
CLP - Contract Laboratory Program
Field Dup. - Blind Field Duplicate
Freq. - The frequency of QC samples given as a ratio of QC sample per field samples collected
Lab Dup. - Laboratory Duplicates
MS - Matrix Spike
MSB - Matrix Spike Blank
MSD - Matrix Spike Duplicate
PCBs - Polychlorinated biphenyls
PCDDs/PCDFs - Polychlorinated dibenzo p-dioxins/polychlorinated dibenzofurans
TAL - Target Analyte List Constituents
TCL - Target Compound List Constituents

(See Notes on Page 3)

Appendices

APPENDIX A

SEDIMENT SAMPLING PROCEDURES

SEDIMENT SAMPLING PROCEDURES

I. Introduction

The general procedures to be utilized in obtaining sediment samples from the river, creeks, ponds, impoundments, and OU cells are outlined below. Lexan® tubing will be the primary method used to collect sediment cores. The tubing may be replaced with a calibrated rod if just probing is being practiced. If the river bed cannot be penetrated by the Lexan® tubing due to large cobbles, boulders, or bedrock, an attempt will be made using a standard split-spoon sampler or a stainless steel sediment corer. If no sample is obtained, work will proceed to the next location. A hand-held dredge sampler will be used for Portage Creek grab samples.

If sampling is being conducted for semi-volatile organic compounds, a standard split-spoon or stainless steel sediment corer will be used in place of Lexan® tubing. The core will be inserted with a straight, vertical entry into the sediments to secure a representative cross-section sample.

II. Materials

The following materials will be available, as required, during sediment sampling activities:

- Personal protective equipment (as required by the Health and Safety Plan);
- Cleaning equipment (as required in Appendix F);
- Boat;
- Aluminum or stainless steel tray;

- Electrical tape;
- Lexan® tubing with end caps, standard split-spoon, and/or stainless steel sediment corer;
- Stainless steel core driver block;
- Hand-held dredge with rope;
- Calibrated rod for sediment depth measurement;
- Stainless steel spatula;
- Brass push rod;
- Handsaw or knife;
- Vacuum pump;
- Camera and film;
- Transport container with ice;
- Appropriate sample containers and forms; and
- Field notebook.

III. Procedures for Lexan® Tube Sampling

1. Identify the proposed sample location on the sampling log sheet (Attachment A-1), sediment probing and characterization log (Attachment A-2) or field notebook along with other appropriate information collected during sediment sampling activities.
2. Don personal protective equipment (as required by the Health and Safety Plan).
3. At each sample location, lower a section of Lexan® tube until it just reaches the top of sediment. Measure the depth of water. (Sections

of Lexan® tube may need to be spliced together in deep water locations).

4. Push the Lexan® tube into the sediment by hand until refusal. Measure the depth of sediment. If the procedure is being performed to determine sediment depth (probing), a calibrated rod may be used in place of the Lexan® tube. If the procedure is being performed to collect samples for laboratory analysis, continue with Step 5.
5. Drive the tube several more inches, using a stainless steel core driver block, and measure the distance. This procedure is performed to obtain a "plug" at the bottom of the core and prevent the loose sediment from escaping.
6. Place a vacuum pump on the top end of the Lexan® tube and create a vacuum to prevent the sediments/plug from escaping.
7. Slowly pull the tube from the sediment, twisting it slightly as it is removed (if necessary).
8. Before the tube is fully removed from the water, place a cap on the bottom end of the tube while it is still submerged.
9. Keeping the tube upright, wipe the bottom end dry and seal the cap with electrical tape.
10. Transport the core sample to the shore.
11. While still keeping the core upright, use a handsaw to make a horizontal cut in the tube approximately one inch above the sediment.
12. Re-cap the cut end of the tube, seal the cap with electrical tape, and mark this end as "TOP".
13. Wipe the tube dry.

14. Place a completed sample label on the tube.
15. Record the following information on both the tube and on the cap: 1) sample number; 2) sampling date; and 3) sampling time.
16. If the core is to be photographed, the Photograph Form in Attachment A-3 is to be filled out and photographed.
17. Place the core sample upright in a container with ice.
18. Repeat the above procedures until all core samples are collected.
19. Sediment cores will be extruded from the Lexan® tubing onto an aluminum or stainless steel tray. Cores will be sectioned into the required depth-proportioned increments based on the ratio of the measured sediment depth to the recovered sediment depth to account for sample compression or expansion during collection. Each increment will be individually packaged.
20. Core sections may be frozen to facilitate sectioning when sediment is extremely loose.
21. The handsaw or knife used to section the core should be cleaned (as described in Appendix F) between each cut.
22. Label all sample containers with: 1) site, 2) project number, 3) location number, 4) sample interval, 5) date, 6) time of core collection, and 7) names of sampling personnel.
23. Handle, pack, and ship the samples in accordance with the procedures in Appendix G.

IV. Procedure for Sediment Probing

The calibration rod will be used to probe sediment depths along the sediment characterization transects. Measurements made of location, depth, time, and field samples will be noted in the field notebook or sediment probing log (Attachment A-2).

V. Procedures for Hand-Held Dredge Sampling

1. Identify the proposed sample location and the appropriate information collected during sediment sampling activities in the field notebook.
2. Don personal protective equipment (as required by the Health and Safety Plan).
3. At each sample location, drop opened dredge from side of boat making sure that the end of the rope is maintained at all times inside the boat.
4. Once the dredge has been allowed to settle into the bottom sediments, a hard pull on the rope will close the sediments inside the dredge.
5. Retrieve the dredge into the boat.
6. Open the dredge to allow the sediments to empty onto a stainless steel tray.
7. Describe and record sample descriptions.
8. Place into appropriate containers with stainless steel spatula.
9. Label all sample containers with: 1) site, 2) project number, 3) location, 4) sample interval, 5) date, 6) time of sample collection, and 7) names of sampling personnel.

10. Handle, pack, and ship the samples using the chain-of-custody procedures in accordance with Appendix G.

VI. Survey

A field survey control program will be conducted using standard instrument survey techniques to document the sediment sampling location.

VVI. Equipment Cleaning

Equipment cleaning of the handsaw or knife used for core sample sectioning will be performed between each cut as described in Appendix F. Equipment cleaning of any sampling equipment which is re-used at another sample location, will be performed as described in Appendix F.

VI. Disposal Methods

All water generated during cleaning procedures will be collected and contained on site for treatment with a portable activated carbon unit. The discharge will be sprinkled onto the surrounding ground surface. After 2,000 gallons has been treated in the activated carbon unit, effluent will be sampled in order to determine if break-through has occurred.

Personal protective equipment such as gloves, disposable clothing, and other disposable equipment, resulting from personnel cleaning procedures and from soil sampling and handling activities, will be placed in plastic bags. These bags will be transferred into appropriately labeled 55-gallon drums for disposal at an appropriate hazardous waste facility, if necessary. Sediments will be placed in sealed 55-gallon steel drums or covered roll-off boxes and stored in a secured

area. Once full, the material will be analyzed to determine the appropriate disposal method. Material from different areas will be placed in different boxes. "Clean" and suspected PCB-containing material will also be segregated.

ATTACHMENT A-1 (TO APPENDIX A)

SEDIMENT SAMPLING LOG

SEDIMENT SAMPLING LOG

Location	Total Core Depth	Depth of Water	Sediment Penetrated	Sediment Recovered

Sample ID	Increment	Visual Description

Weather	
Air Temperature	
Samplers	
Date	
Time	

Comments: _____

_____

_____

_____

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ATTACHMENT A-2 (TO APPENDIX A)

SEDIMENT PROBING AND CHARACTERIZATION LOG

SEDIMENT PROBING AND CHARACTERIZATION LOG

Samplers	Date	Time	Probe Type	Transect

Distance from Bank	Depth of Water	Depth of Sediment	0-to4-inch Sample?	Description of Sediment

Comments: _____

_____

_____

_____

ATTACHMENT A-3 (TO APPENDIX A)

PHOTOGRAPH FORM

This End
Top

Sample ID: _____

Location:

Transect _____

Position _____

Depth of Water: _____ ft
Total Length of Core: _____ ft
Core Interval: _____ ft
Samplers Initials: _____

Date: ___/___/___ Month/Day/Year

Time:* ___:___ Hours: Min

* Military Time

BLASLAND & BOUCK ENGINEERS, P.C.
ENGINEERS & SCIENTISTS

APPENDIX B

SOIL/RESIDUALS SAMPLING PROCEDURES

SOIL/RESIDUALS SAMPLING PROCEDURES

I. Soil/Residuals Boring Sampling

Introduction

Soil borings will be completed using the hollow-stem auger drilling method or the driven casing drilling method to a depth specified by the supervising geologist/engineer. In situations where physical site features limit the use of drill rigs, soil borings will be completed with a hand driven auger, a portable power auger, or a tripod and split-barrel sampler (split-spoon) depending on the required depth and subsurface material.

Samples of subsurface material encountered during the drilling of soil borings will be collected continuously to the required depth of the boring, or as directed by the supervising geologist. The sampling method employed will be American Society for Testing and Materials (ASTM) D1586 - Standard Method for Penetration Test and Split-Barrel Sampling of Soils or ASTM D4700 - Soil Sampling from the Vadose Zone.

Relatively undisturbed samples will be collected for geotechnical evaluation using ASTM D1587 - Thin-walled Tube Sampling of Soils or ASTM D4700. Alternatively, a piston sampler may be used to sample certain materials. Field vane shear testing will be performed at selected borings according to ASTM D2573.

Materials

The following materials, as required, shall be available during soil boring sampling:

- Personal protective equipment (as required by the Health and Safety Plan);
- Cleaning equipment (as required in Appendix F);
- All drilling equipment required by ASTM D-1586;
- Appropriate sample containers and forms;
- Insulated coolers with ice;
- Photoionization detector;
- Field notebook; and
- Stainless steel spatula.

Procedures

Soil samples will be taken to provide a continuous profile of the subsurface. A geologist will be on-site during the drilling operations to fully describe each soil sample including: 1) soil type; 2) color; 3) percent recovery; 4) relative moisture content; 5) texture; 6) grain size and shape; 7) consistency; and 8) any other noteworthy observations. The descriptions will be recorded on a subsurface log (Attachment B-1).

Upon retrieval of split-spoon samples, representative portions of the bottom 1.5-foot depth increment from each sample (unless modified by site-specific conditions), will be placed in appropriate sample containers. One representative portion of each sample will be placed in a clean jar, covered with aluminum foil, and let stand for several minutes. The head space will then be screened with a photoionization detector (PID) or equivalent field instrument and the relative concentration of total volatile organic compounds (VOCs) in the sample will be recorded on the boring log.

Sample containers will be labeled, temporarily stored on-site, and transported to the appropriate testing laboratory at the end of the day. The samples will be handled, packed, and shipped in accordance with the procedures set forth in Appendix G.

The supervising geologist will be responsible for documenting drilling events in the field notebook. The drilling contractor will be responsible for obtaining accurate and representative samples; informing the supervising geologist of changes in drilling pressure and loss of circulation (when using drilling fluids); and keeping a separate subsurface log of soils encountered, including blow counts [i.e., the number of blows from a soil sampling drive weight (140 pounds) required to drive the split-spoon sampler in 6-inch increments] as described in Attachment B-2.

II. Floodplain Soil Sampling

Introduction

Floodplain soil samples, including remnant deposit areas, will be collected using a hand-driven, split-spoon sampler, a stainless steel bucket auger, or a spade and scoop as determined by the field supervisor depending on the subsurface material. Hand borings will be performed in areas where truck-mounted rigs are unable to gain access. Samples of subsurface material encountered during this operation will be collected continuously to a predetermined depth for floodplain soil/sediments and remnant deposit materials. The individual depths are detailed in the Work Plan under the appropriate sections.

Materials

The following materials, as required, will be available during floodplain soil sampling:

- Personal protective equipment (as required by the Health and Safety Plan);
- Cleaning equipment (as required in Appendix F);
- Aluminum or stainless steel tray;
- Field notebook;
- Appropriate sample containers and forms;
- Insulated coolers with ice;
- Split-spoon sampler;
- Stainless steel bucket auger;
- Brass push rod;
- Spatula or knife;
- Hand spade;
- Stainless steel scoop;
- Stainless steel lab spoon or equivalent; and
- Camera and film.

Procedures

The following procedures will be employed to collect floodplain soil samples:

1. Put on personal protective equipment (as required by the Health and Safety Plan).

2. Drive a precleaned split-spoon sampler (or stainless steel bucket auger) with a straight, vertical entry into the soil, so as to secure a reasonably representative sample.
3. Remove the sampler and place on an aluminum or stainless steel tray.
4. With a precleaned spatula or knife remove all excess soil from the outside of the sampler to avoid cross contamination over the sample depth.
5. Extract the sample onto a stainless steel tray.
6. Place the sample in the appropriate sample jar.
7. Record all appropriate information in the field notebook.
8. Label, handle, pack, and ship the samples in accordance with Appendix G.

As an alternative, when not sampling for volatiles, steps 2, 3, and 4 above may be replaced with steps a, b, and c as follows:

a. Carefully remove the top layer of soil to the desired depth with a precleaned spade.
b. Using a precleaned stainless steel scoop or trowel, remove and discard a thin layer of soil from the area which comes in contact with the spade.
c. Carefully remove the desired sample with a precleaned stainless steel lab spoon or equivalent.

III. Survey

A field survey control program will be conducted using standard instrument survey techniques to document the boring, surficial soil, or floodplain sampling location and elevation.

IV. Equipment Cleaning

Equipment cleaning will be performed at the beginning of the sampling event and between each separate sampling location as described in Appendix F.

V. Disposal Methods

All water generated during cleaning procedures will be collected and contained on site for treatment with a portable activated carbon unit. The discharge will be sprinkled onto the surrounding ground surface. After 2,000 gallons have been treated in the activated carbon unit, effluent will be sampled in order to determine if break-through has occurred.

Personal protective equipment, such as gloves, disposable clothing, and other disposable equipment resulting from personnel cleaning procedures and soil sampling and handling activities will be placed in plastic bags. These bags will be transferred into appropriately labeled 55-gallon drums for disposal at an appropriate hazardous waste facility, as necessary.

Soil and residual materials will be placed in sealed 55-gallon steel drums or covered roll-off boxes and stored in a secured area. Once full, the material will be analyzed to determine the appropriate disposal method. Material from different areas will be placed in different containers. "Clean" and suspected PCB-containing material will also be segregated.

ATTACHMENT B-1 (TO APPENDIX B)

SUBSURFACE LOG

BLASLAND & BOUCK ENGINEERS, P.C.

DATE COMPLETED
CLASSIFIED BY:

BORING

SURFACE ELEVATION:
DATE STARTED:

PROJECT:
LOCATION:

PROJECT NO.:
PAGE: 1 of 1

DEPTH (FT)	SAMPLES	SAMPLE/RUN NO.	SOIL DATA: RECOVERY (FT)	SOIL DATA: BLOWS/6 IN.	SOIL DATA: PID HEADSPACE (ppm)	ROCK DATA: FROM/TO	ROCK DATA: % RECOVERY	ROCK DATA: % ROD	ROCK DATA: AVERAGE RATE (MIN./FT)	WELL COLUMN	GEOLOGIC COLUMN	SUBSURFACE LOG: SOIL/ROCK CLASSIFICATION	ROCK FEATURES
5													
0													
-5													
-10													
-15													
-20													
-25													

ATTACHMENT B-2 (TO APPENDIX B)

DESCRIPTION OF STANDARD PENETRATION TEST (SPT)

DESCRIPTION OF STANDARD PENETRATION TEST (SPT)

The Standard Penetration Test (SPT) is a common soil and weak rock investigation technique that is used world-wide. The current standard method for the North American use of the SPT is described in ASTM D1586. The test is widely used in geotechnical and hydrogeological studies in many geological environments.

The concept of a standard penetration resistance was first introduced in North America in 1927 and was used extensively by the Raymond Concrete Pile Company. Over the next two decades, several variants of the penetration test were used with different sampler sizes and hammer configurations. Terzaghi and Peck's landmark 1948 textbook "Soil Mechanics in Engineering Practice" and U.S. Army Corps of Engineer's research focused on the current SPT configuration as the preferred system. Further research in the 1950s resulted in the assignment of relative density percentages to specific ranges of SPT N-values. The SPT test, essentially in its present form, was first codified by ASTM in 1958 as Standard Method Designation D1586.

Since ASTM and other standards organizations codified the SPT, extensive research, predominantly in North America, Britain, and Japan, has provided useful correlations for using the SPT N-values in evaluating the relative density of sands. This information can then be used for evaluating settlement and strength characteristics of the in-situ soils. The major uses of the SPT have been for foundation design and for evaluating liquefaction potential of sand deposits. Clay shear strengths have also been correlated to the SPT N-values. Since the

clay shear strength is a function of the clay moisture content which is in turn related to its consolidation history, and since the sand relative density is also a function of its consolidation history, the SPT can be used to aid in evaluating the general consolidation history of a soil deposit and therefore can help in determining its geologic history. Since permeability is a function of soil density, data on the soil density can also be used to aid in correlating permeability of different zones of a soil deposit.

The test is relatively simple and almost all U.S. exploration drilling rigs are equipped to perform it. The test uses a 140 pound weight falling freely for a distance of 30 inches to drive a 2-inch outside diameter by 1-3/8-inch inside diameter spit barrel sampler (split spoon) into the soil in a boring. The sampler is typically about 30 inches in length, although other lengths are permitted by ASTM. The blow counts required to drive the sampler are counted and recorded for each 6-inch increment of spoon advancement. The spoon is driven at least 18 inches unless refusal is encountered. Refusal is defined by ASTM as one of three occurrences:

- A total of 50 blow has been applied during any of the 6-inch increments;
- A total of 100 blow has been applied; or
- There is no observed advance of the sampler during the application of 10 successive blows.

This definition of refusal is often used as a basis for evaluating the depth to hardpan or sound bedrock during investigations.

The blowcounts obtained during performance of the SPT are summarized by the SPT N-value. The SPT N-value is defined as the sum of the blowcounts required to drive the sampler during the second and third 6-inch increments. The blowcounts for the first 6 inches are not used as it is assumed that the drilling process has disturbed that zone. Correction factors may be applied to the N-values based on the grain sizes of the soil or sample depth.

APPENDIX C

SURFACE WATER SAMPLING PROCEDURES

SURFACE WATER SAMPLING PROCEDURES

I. Introduction

Several methods for collecting surface water samples are available, depending on the type of surface water to be sampled (e.g., rivers, creeks, ponds, impoundments). Regardless of the sample collection method used, sampling will take place under baseflow and event-specific conditions.

II. Materials

The following materials will be available, as required, during surface water sampling.

- Personal protective equipment (as required by the Health and Safety Plan);
- Cleaning equipment (as required in Appendix F);
- Boat;
- Rope;
- Surveyor's rod;
- Duct tape;
- Thermometer;
- Large glass container for mixing;
- Teflon® or glass stirring rod;
- Graduated cylinder or beaker;
- Temperature/Ph/conductivity meter;
- Dissolved oxygen meter;

- Turbidity meter;
- Erlenmeyer flask (if necessary);
- Measuring tape;
- Appropriate sampling containers (prepared with appropriate preservatives by the laboratory prior to each sampling event);
- Appropriate forms or field notebook;
- Insulated coolers with ice; and
- Appropriate water sampler and supporting equipment from among the following:
  a. A surface water grab sampler (Attachment C-1) consisting of a 1,000 ml beaker, adjustable clamp, and two- or three-piece telescoping aluminum tube or an equivalent sampling device; or
  b. A peristaltic pump (Attachment C-3) with a short piece of medical-grade silicone tubing and Teflon^{R} tubing; or
  c. A DH-76 depth-integrating sampler (Attachment C-5) with a velocity meter and appropriate nozzles.

III. Surface Water Sampling Procedures

A. The following procedures will be used to obtain mid-depth grab samples;

1. Identify surface water sampling location in field notebook along with other appropriate information.
2. Don personal protective equipment (as required by the Health and Safety Plan).

3. Clean the sampling equipment in accordance with the procedures in Appendix F.
4. Assemble the surface water grab sampler (Attachment C-1). Make sure that the sampling beaker and the bolts and nuts that secure the clamp to the pole are tightened properly.
5. Obtain sample by slowly submerging the beaker with minimal surface disturbance (if sampling a stream, the beaker opening will be upstream).
6. Retrieve the water sampler from the surface water with minimal disturbance so as to avoid collecting solids resuspended by the sampling actions.
7. Remove the cap from the large glass mixing container and slightly tilt the mouth of the container below the sampling device.
8. Empty the sampler slowly, allowing the sample stream to flow gently down the side of the container with minimal entry turbulence.
9. Continue delivery of the sample until the mixing container contains a sufficient volume for all laboratory samples.
10. Mix the entire sample volume with the stirring rod and transfer the appropriate volume into the laboratory sample jar. When sampling for volatiles, minimize the mixing operation to the extent possible to prevent volatilization.
11. Secure the sample jar cap tightly.

12. Use the remaining sample volume to measure pH, conductivity, temperature, dissolved oxygen, and turbidity as outlined in Appendix D.
13. Label, handle, pack, and ship the samples in accordance with the procedures in Appendix G.
14. Measure the water temperature at about mid-depth and measure the ambient air temperature; and
15. Record required information on the appropriate form (Attachment C-2) or field notebook.

B. At locations where a peristaltic pump (Attachment C-3) will be used, the following procedures will be followed:

1. Identify sampling location in field notebook along with other appropriate information.
2. Don personal protective equipment (as required by the Health and Safety Plan).
3. Clean the sampling equipment in accordance with the procedures in Appendix F.
4. Install clean, medical-grade silicone tubing in the pump head, as per the manufacturer's instructions. Allow sufficient tubing on the discharge side to facilitate convenient dispensation of liquid into sample bottles and only enough on the suction end for attachment to the intake line. This practice will minimize sample contact with the silicone pump tubing.

5. Select the length of Teflon[R] tubing necessary to reach the required sample depth and attach to intake side of pump tubing. Taping the Teflon[R] tubing to a surveyor's rod will facilitate reaching the required depth.
6. If possible, allow several liters of sample to pass through the system before actual sample collection. Collect this purge volume and return the water after the sample aliquot has been withdrawn.
7. Using a graduated cylinder or beaker as a measuring device, collect equal volumes of water at depths of 0.2, 0.5, and 0.8 times the total water depth, respectively.
8. If sampling for VOCs, the sample jar or an Erlenmeyer flask will be installed on the suction side of the pump (as shown in Attachment C-3) as volatiles may adhere to the silicone tubing.
9. The samples taken from the three depths noted above will be combined into one composite sample for the given location.
10. After sample collection, follow Steps 7 through 14 described in the preceding Section III.A.
11. Record required information on the Peristaltic Pump Sampler Log (Attachment C-4) or the field notebook.
12. All tubing will be discarded between sampling locations, and not re-used.

C. At locations where a DH-76 depth-integrating sampler (Attachment C-5) will be used, the following procedures will be followed (to the extent possible):

1. Identify the sampling location in the field notebook along with other appropriate information.
2. Don personal protective equipment (as required by the Health and Safety Plan).
3. Clean the sampling equipment in accordance with the procedures in Appendix F.
4. The seal between the sampling jar and the rubber gasket should be periodically checked by inserting a jar into the sampler, blocking the exhaust port with a finger, and forcing air into the sampler nozzle. If air escapes around the mouth of the sampling jar, the jar may be improperly inserted or the gasket may be defective. A pipette bulb or similar device can be used to pressurize the sampler.
5. Measure and record the water depth (D) at the mid-width of the river or creek with a surveyor's rod.
6. Determine the largest nozzle diameter that can be used to fill the jar to the "high water level" using the following formula:

$$d \leq \frac{1.011}{(D)^{1/2}} \qquad [1]$$

where:

d = Nozzle diameter in inches

D = Water depth in feet

7. Three nozzle diameters are available for the DH-76 sampler--0.25 (1/4), 0.1875 (3/16), and 0.125 (1/8) inches. Select the largest nozzle which is less than or equal to (d) determined in Equation

[1] above. If the value of (d) is less than 0.125 (1/8) inches, the 1/8 inch nozzle should be used to collect the sample and be recorded in the field book.

8. Measure and record the water velocities at the mid-width of the river at 0.2 and 0.8 depth increments (Attachment C-7). The average of these values will be considered the mean stream velocity (v_m).

9. Calculate the transit time (T_t) that will be required to fill the jar to the "high water level" using the nozzle selected in step 7 above and the following formula. (Transit time is the time required to lower the sampler to the stream bottom and then raise it to the surface.)

$$T_t = \frac{C_d}{v_m} \qquad [2]$$

where: T_t = Transit time in seconds

C_d = Nozzle constant in feet ($C_{1/4}$ = 80, $C_{3/16}$ = 145, $C_{1/8}$ = 325)

v_m = Mean stream velocity in feet/second

10. If the transit time is impractically slow, the sample should be collected using two or more passes with the selected nozzle. this determination will be left to the discretion of the operator. In extremely slow moving water, the sediment is generally fine-grained material, and the sampled water column concentration

would not be significantly affected by using a somewhat faster transit time.

11. If the transit time is not impractically slow, the sample should be collected using a single pass.
12. Insert a clean jar and gasket in the sampler.
13. Check to see that there are no obstructions in the intake and exhaust tubes.
14. Attach the nozzle that was selected in Step 7.
15. Lower the sampler to the water surface so that the tail vane is in the water and the nozzle is above the water surface and pointing upstream.
16. Allow the sampler to orient itself to the flow direction.
17. Lower the sampler to the stream bed using a constant hand over hand motion (may be assisted by a hand operated winch assembly, if necessary).
18. When the sampler reaches the bottom, immediately reverse the direction and raise the sampler out of the water using the same hand over hand motion. Some difficulty may arise when determining whether the sampler has reached the stream bottom. If this problem arises, one-foot markings on the suspension rope can be used to indicate when the approximate stream bottom has been reached. This method should be used to avoid burying the sampler in sediment or striking rocks.

The total time required to complete the lowering and raising of the sampler should be approximately equal to the transit time (T_1) determined in Step 9. The rate used in lowering the sampler does not need to be exactly the same as the rate used to raise the sampler. However, both rates must be constant. For example, given a calculated transit time of 10 seconds, an operator lowers the sampler to the stream bottom in 6 seconds. The operator must now adjust the rate so that the sampler is raised to the surface (at a constant rate) in 4 seconds. Both the time to lower the sampler to the stream bottom and the time to raise the sampler to the surface should be recorded.

19. After the sampler has been removed from the water, the water level should be checked. If the water level is above or within 1/2 inch below the calibrated "high water level", the sample must be discarded and another obtained using the same bottle (water running out of the nozzle as the sample is raised out of the water is an indication that the bottle has been overfilled).

20. A sample which has a water level within 1/2 to 2 inches below the "high water level" will be considered an optimum sample. A sample which has a water level more than two inches below the "high water level" is still an adequate sample, but is not as desirable as a sample which has a water level within the 1/2- to 2-inch range. In this case, the actual transit time should be checked against the calculated transit time and adjustments made

as necessary. Samples with water levels below the optimum range which are collected for analysis should be noted on the DH-76 sample field log (Attachment C-6).

21. As noted previously, two or more passes may also be required in slow moving streams to fill the DH-76 sample jar. In an extremely shallow stream, it is sometimes easier and more practical to make the cycle from the surface to the bed and return more than once. The decision to repeat the sampling procedures with the previous "less than optimum" sample intact will be at the field operator's discretion. As an alternative, partially full samples can be collected as needed to obtain the required volume. In these situations, all notes and transit times (raising and lowering) should be recorded for each pass.
22. After sample collection, follow Steps 7 through 14 described in Section III.A above.
23. The gasket and DH-76 sample jar should be discarded when moving to a new sample location.
24. Record required information on the appropriate form or the field notebook.

IV. Velocity Profile Measurement Procedures

The following procedures will be used to determine the velocity profile at select river/creek cross sections:

1. Don personal protective equipment (as required in the Health and Safety Plan).
2. Measure the width of the river/creek and divide into equally spaced measurement locations. For rivers/creeks less than 30 feet in width, the spacing should be 5 feet. For rivers/creeks between 30 feet and 100 feet in width, the spacing should be 10 feet; and for rivers/creeks greater than 100 feet in width, the spacing should be 20 feet.
3. Turn control knob on velocity meter to calibrate. It should read from 9.25 to 10.00. If not, replace the batteries or send for repair.
4. Lower the surveyor's rod and measure and record the water depth to the nearest 0.1 foot at each measurement location on the Velocity Profile Measurement Log (Attachment C-7);
5. Attach the velocity meter probe to the surveyor's rod, measure, and record the velocity at depths equalling 0.2 and 0.8 times the total river/creek depth at each measurement location; and
6. To calculate the flow rate, multiply the average of the velocities read by the average of depths by the total river width.

$$Q = V \times D \times W$$

where: Q = discharge in cubic foot per second^3
V = average velocity in feet per second
D = average water depth in feet
W = river in width in feet

IV. Survey

A field survey control program will be conducted using standard instrument survey techniques to document the surface water sampling locations.

V. Equipment Cleaning

Equipment cleaning will occur at the beginning of the sampling event and between each sampling location as described in Appendix F.

VI. Disposal Methods

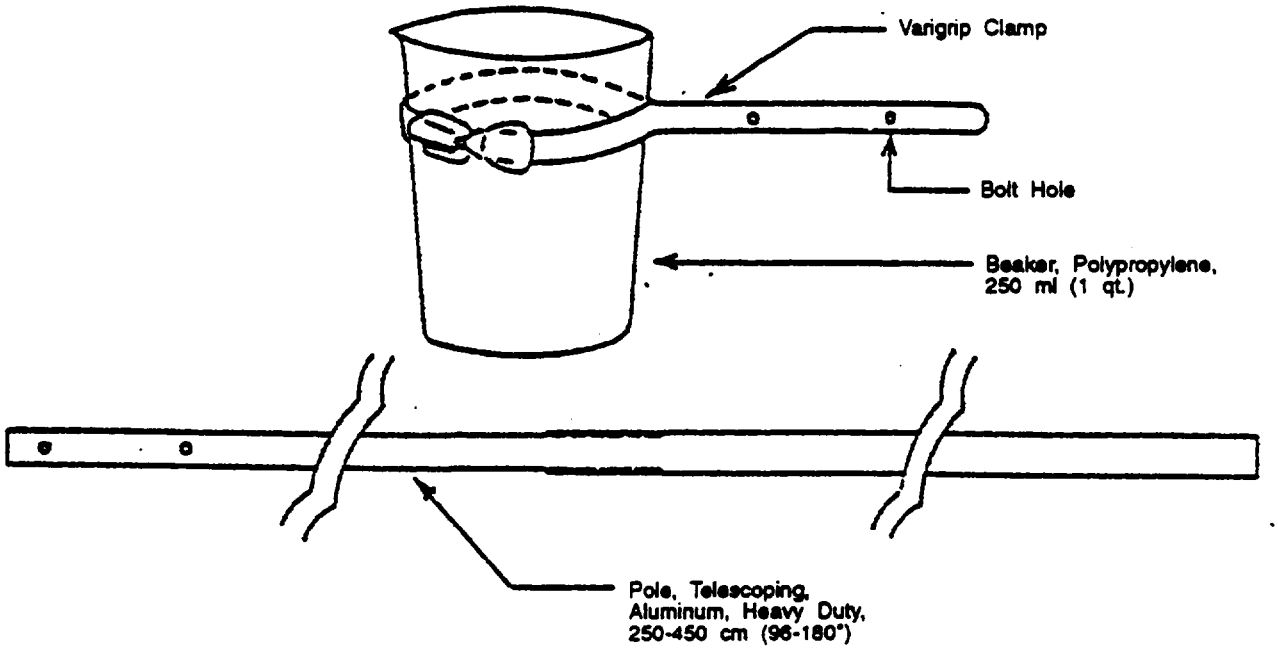
All water generated during cleaning procedures will be collected and contained on site for treatment with a portable activated carbon unit with the discharge being sprinkled onto the surrounding ground surface. After 2,000 gallons has been treated in the activated carbon unit, effluent will be sampled in order to determine if break-through has occurred.

Personal protective equipment such as gloves, disposable clothing, and other disposable equipment, resulting from personnel cleaning procedures and from soil sampling and handling activities, will be placed in plastic bags. These bags will be transferred into appropriately labeled 55-gallon drums for disposal at an appropriate hazardous waste facility, as necessary.

ATTACHMENT C-1 (TO APPENDIX C)

SURFACE WATER GRAB SAMPLER

SURFACE WATER
GRAB SAMPLER



NOTE:

Not to Scale

ATTACHMENT C-2 (TO APPENDIX C)

SURFACE WATER SAMPLING FIELD LOG-GRAB

SURFACE WATER SAMPLING FIELD LOG-GRAB

Sample Depth	
Approximate Flow Rate	
Volume of Sampling Device	
Total Water Depth	
Distance From Bank	
Depth Below Surface of Water Removed	

Location	
Weather	
Air Temperature	
Samplers	
Date	
Time	

Temperature	
Conductivity	
pH	
Dissolved Oxygen	
Turbidity	

Comments _____

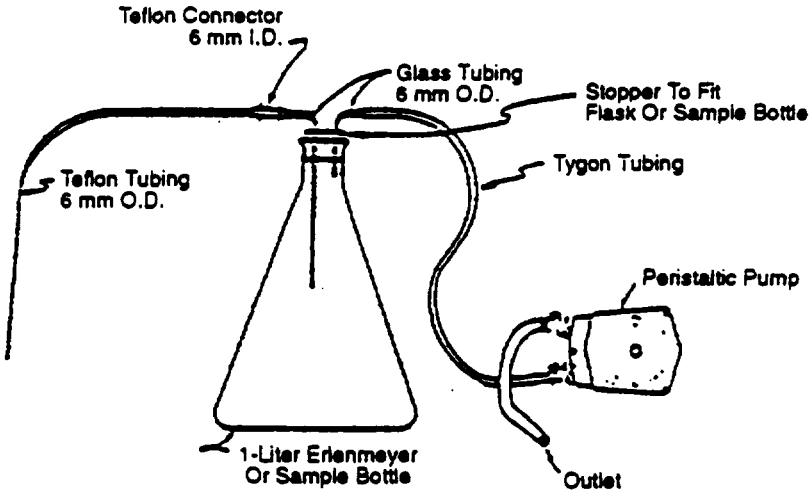
_____

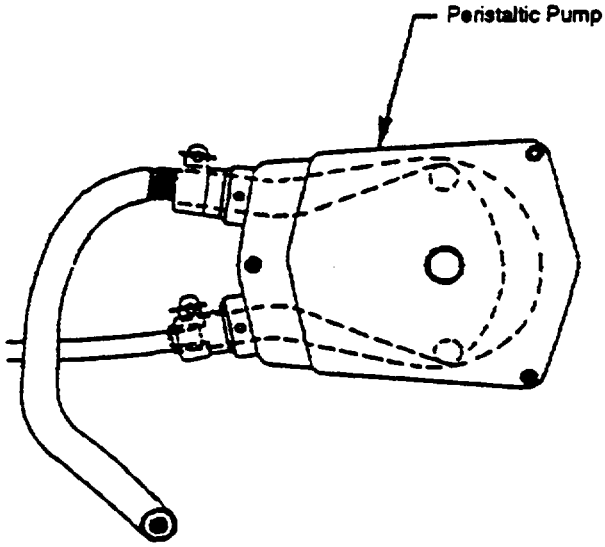
_____

ATTACHMENT C-3 (TO APPENDIX C)

MODIFIED PERISTALTIC PUMP METHOD FOR COLLECTION OF SURFACE WATER SAMPLES

MODIFIED PERISTALTIC PUMP METHOD FOR COLLECTION OF SURFACE WATER SAMPLES





NOTE:

Not to Scale

ATTACHMENT C-4 (TO APPENDIX C)

PERISTALTIC PUMP SAMPLER FIELD LOG

PERISTALTIC PUMP SAMPLER LOG

Station	Depth from Surface	Velocity	%	Volume Collected	Analysis

Location	
Weather	
Air Temperature	
Samplers	
Total Water Depth	
Date	
Time	
Gauge Reading	

Temperature	
Conductivity	
pH	
DO	
Turbidity	

Comments: _____

_____

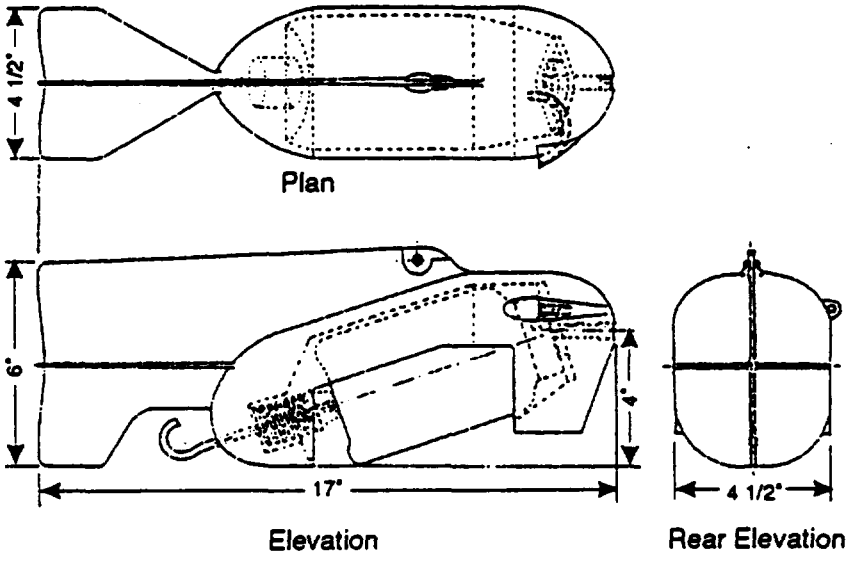
_____

6/11/93
1693362S

ATTACHMENT C-5 (TO APPENDIX C)

DH-76 DEPTH-INTEGRATING SURFACE WATER SAMPLER

DH-76 DEPTH-INTEGRATING SURFACE WATER SAMPLER



NOTE:

Not to Scale

ATTACHMENT C-6 (TO APPENDIX C)

DH-76 SAMPLER FIELD LOG

DH-76 SAMPLER FIELD LOG

Location	
Weather	
Air Temperature	
Samplers	
Total Water Depth	
Date	
Time	
Flow	

Nozzle Size	
Calculated Transit Time (T_t)	
Actual T_t	
Average Velocity	

Sample ID	Depth		Actual T_t		Pass No.	Analysis
	0.2	0.8	Down	Up		

Temperature	
Specific Conductance	
pH	
Turbidity	
Dissolved Oxygen	

Comments: _____

_____

_____

ATTACHMENT C-7 (TO APPENDIX C)

VELOCITY PROFILE MEASUREMENT LOG

VELOCITY PROFILE MEASUREMENT LOG

Station	Depth (ft)		Velocity (fps)		Average Velocity (fps)	Total Depth (ft)
	0.2	0.8	0.2	0.8		
				Average		

Location	
Weather	
Air Temperature	
Samples	
Total River Width	
Date	
Time	
Flow	

Comments:

/27/93
_2933625

APPENDIX D

FIELD PROCEDURES FOR WATER QUALITY MEASUREMENTS

FIELD PROCEDURES FOR WATER QUALITY MEASUREMENTS

I. Introduction

Water quality parameters, such as dissolved oxygen (DO), turbidity, specific conductance, pH, and temperature, of natural waters are usually measured in the 415ld. The pH and conductivity will be recorded using a portable meter with temperature-compensating pH and conductivity electrodes. Turbidity will be measured in Nephelometric Turbidity Units (NTU) with a turbidity meter, dissolved oxygen with a DO meter. The temperature will be measured with a glass, digital, bimetal thermometer, or combination temperature/pH/conductivity meter. In the case of sampling ground water, hydrochemical parameters should be recorded initially, during purging, and after sampling. Attachment D-1 through D-3 contain the appropriate calibration and maintenance logs for the above referenced meters. Table D-1 provides the precision and accuracy control limits for the meters. Table D-2 provides calibration freqency and preventative maintenance for the meters.

II. Materials

The following materials, as required, shall be available during field measurement of water quality:

- Personal protective equipment (as specified in the Health and Safety Plan);
- Clean glass container;
- Temperature/pH/conductivity meter;

- Sodium chloride standard solution, 1,000 mg/L;
- pH buffers 7.00 and 4.00;
- Turbidity meter;
- Gelex secondary standards;
- Formazin turbidity standard dilutions;
- Nephelometric sample tubes;
- Dissolved oxygen meter;
- Spare Teflon® membranes;
- Cleaning equipment (as required in Appendix F);
- Fine screwdriver (for meter calibration adjustments);
- Extra batteries for the meters;
- Distilled/deionized water; and
- Appropriate forms and field notebook.

III. Procedures for Measuring pH

Calibration Procedure

The pH meter will be calibrated daily.

1. Switch on instrument.
2. Connect electrode to meter via the BNC connector and remove protective cap from electrode.
3. Rinse end of electrode in distilled/deionized water.
4. Measure and record temperature of buffer solutions.
5. Immerse pH electrode in pH buffer 7.00, set the temperature adjust dial to that of the buffer 7.00, and allow sufficient time

for the electrode to stabilize. Adjust the calibration dial for the correct readout.

6. Remove electrode from buffer and rinse with distilled/deionized water.
7. Immerse pH electrode in buffer 4.00, set the temperature control to that of the buffer 4.00, and allow sufficient time for the electrode to stabilize. Adjust the Slope Control for the correct readout.
8. Rinse electrode with distilled/deionized water. The meter is calibrated and ready for use.

Operation Procedure

1. Calibrate pH meter.
2. Rinse probe in distilled/deionized water.
3. Fill two 100-milliliter plastic disposable beakers with water from the sample.
4. Measure and record temperature of sample. Adjust temperature dial for ambient water temperature.
5. Insert probe into one sample beaker and obtain a reading. The meter will read between 0 and 14, in 0.01 increments.
6. Rinse probe off in distilled/deionized water.
7. Repeat Step 4, 5, and 6 in other beaker.
8. Log results in field notebook and the average will be the actual result.

Maintenance Procedures

1. Replace batteries on a regular basis.
2. Store electrode in protective casing when not in use.
3. Keep records of usage, maintenance, calibration, problems, and repairs.
4. After use, the meter will be inspected and the inspection recorded in the field notebook.
5. A replacement meter will be available onsite or ready for overnight shipment.
6. pH meter will be sent back to manufacturer for service when needed.

IV. Procedures for Measuring Conductivity

Conductivity is the ability of a solution to pass an electric current. This current is carried by inorganic dissolved solids. The measurement of conductivity is useful to relate the chemical purity of the water and the amount of dissolved solids in a solution.

Calibration Procedure

The conductivity meter will be calibrated daily.

1. Be sure the probe is clean.
2. Soak the probe in distilled/dionized water for at least 30 minutes.
3. Remove the probe from the water and fling out drops clinging inside.

4. Immerse the probe to or beyond the vent holes in a beaker containing a 1,000 mg/L Sodium Chloride Standard Solution. Agitate vertically to remove entrapped air.
5. Repeat Steps 3 and 4 at least once more.
6. Press the Power key and CND key. Verify that the LO BAT indication does not appear.
7. Press the 2 milliSiemens per centimeter (mS/cm) range key.
8. Check the reading on the display. It should be 1.990 mS/cm. If adjustment is needed, use a small screwdriver to adjust the CAL control next to the display. Counterclockwise adjustment increases the reading.

Operation Procedure

1. Calibrate the conductivity meter.
2. Rinse probe in distilled/deionized water.
3. Fill two 100-milliliter plastic disposable beakers with water from the sample.
4. Turn meter on to the 2 mS/cm scale.
5. Insert probe into sample beaker and obtain a reading. The meter will read between 0 and 2.0 mS/cm in 0.001 increments.
6. Repeat Step 5 with other beaker.
7. Record both results in the field notebook and average.
8. Rinse probe off in distilled/deionized water.

9. If the electrodes become coated with foreign compounds, the probe should be cleaned with a detergent solution and then rinsed with distilled/deionized water.

Maintenance Procedures

1. Replace batteries on a regular basis.
2. Store electrode in protective casing when not in use.
3. Keep records of usage, maintenance, calibration, and of any problems and repair.
4. After use, the meter will be inspected and the inspection recorded in the log book.
5. A replacement meter will be available on-site or ready for overnight shipment.
6. Conductivity meter will be sent back to manufacturer for service when needed.

V. Procedures for Measuring Temperature

Temperature readings will be taken at each water sampling location to assist in pH and conductivity measurement. It will also assist in chemical and biological interpretations. A thermometer may be part of a pH/conductivity meter or separate.

Operation Procedure

1. Rinse thermometer in distilled/deionized water.
2. Immerse thermometer in the water sample and read it to the nearest degree Celsius (°C).

3. Record reading in the field notebook or relevant log.

Preventative Maintenance

1. Use of a Teflon[R] coated thermometer lends extra strength and shock resistance to guard against accidental breakage.
2. Store in protective casing when not in use.

VI. Procedures for Measuring Turbidity

The measurement of turbidity is useful in that it expresses the amount of suspended particles in the water sample.

Standardization Procedure

Standardization will be performed before each set of tests to ensure consistently accurate results.

1. Turn the instrument off and check the mechanical zero setting. Adjust to a zero NTU reading if necessary.
2. Turn power switch on and perform a battery check.
3. Place the focusing template into the cell holder. This will block all the light from reaching the detector and allow the instrument to be zeroed electronically in Steps 4 and 5.
4. Press the 1.0 range switch and adjust the Zero Control for a reading of zero NTU.
5. Press the 10.0 range switch to verify that the meter still indicates zero NTU. Readjust the Zero Control if necessary.
6. Remove the focusing template and place the appropriate Gelex secondary standard for the turbidity range to be used into the

cell holder. Use the index mark on the standard to orient the vial in the same position each time, thereby eliminating variation due to rotation.

7. Place the light shield over the turbidity standard and allow the meter to stabilize.
8. Adjust the span control for a meter reading equal to the value of the Gelex standard in the cell holder. Remove the light shield and turbidity standard. The instrument is now ready for use.

Calibration Procedures

Each range is calibrated at the factory but should be checked from time to time against fresh Formazin turbidity standard dilutions. Three trimmer potentiometers on the amplifier circuit board provide an adjustment for each range. Check each range as described in the following procedure and make the appropriate adjustments when necessary, using the procedures described in Range Calibration.

1. With the instrument turned off, check the mechanical zero adjustment on the meter face. Adjust for a zero reading if necessary.
2. Turn the instrument on and perform a battery check. Change battery if needed.
3. Place the focusing template into the cell holder, press the 1.0 range switch, and adjust the Zero Control to obtain a zero NTU reading.

4. Remove the focusing template and insert a 0.75 NTU turbidity standard. Adjust the SPAN control for a corrected 0.75 NTU reading.

5. Remove the 0.75 NTU standard and replace it with a 10 NTU standard. Press the 10.0 range switch. The meter should indicate 10 (±0.2) NTU. If it does not, the 10.0 range potentiometer needs adjustment as described in the Range Calibration procedure. Adjust the SPAN control for a reading of exactly 10 NTU.

6. Remove the 10 NTU standard and replace it with the cell riser and 100 NTU standard. Press the 100 range switch. The meter should indicate 100 (±2) NTU. If it does not, the 100 range potentiometer needs adjustment as described in the Range Calibration procedure.

7. Remove the 100 NTU standard and cell riser and insert the 10 NTU standard. Press the 10.0 NTU range switch. Adjust the SPAN control for a reading of exactly 10 NTU.

8. Remove the 10 NTU standard and replace it with a 0.75 NTU standard. Press the 1.0 range switch. The meter should indicate the corrected value for the 0.75 NTU standard (±0.02). If it does not, the 1.0 range potentiometer needs adjustment as described in the Range Calibration procedure.

Range Calibration Procedures

In the event the range adjustment potentiometers on the amplifier circuit board require adjustment, remove the instrument from its case and proceed as follows:

1. With the instrument turned off, check the meter's mechanical zero adjustment. Adjust for a zero reading if necessary.
2. Turn on power and perform a battery check.
3. Place the focusing template into the cell holder, press the 1.0 range switch, and adjust the SPAN control fully counterclockwise.
4. Adjust the Zero Control clockwise to obtain a 0.05 NTU reading on the 1.0 scale.
5. Adjust the SPAN control clockwise to obtain a reading of 0.15 NTU on the 1.0 scale. Do not alter the SPAN control setting for the remainder of this procedure.
6. Press the 100 range switch and adjust the Zero Control for a zero reading.
7. Remove the focusing template and insert the cell riser and 100 NTU Formazin turbidity standard. Cover the standard with the light shield and allow the meter to stabilize. Adjust the 100 range adjustment potentiometer to obtain a full-scale reading.
8. Remove the 100 NTU standard and cell riser and insert the focusing template into the cell holder.
9. Press the 10.0 range switch and adjust the Zero Control for a zero reading.

10. Remove the focusing template and substitute the 10 NTU Formazin standard. Cover with the light shield and allow the meter to stabilize. Adjust the 10.0 range adjustment potentiometer to obtain a full-scale reading.
11. Remove the 10 NTU standard and insert the focusing template.
12. Press the 1.0 range switch and adjust the Zero Control for a zero reading.
13. Remove the focusing template and insert the 0.75 NTU Formazin turbidity standard. Cover with the light shield and allow the meter to stabilize. Adjust the 1.0 range adjustment potentiometer to obtain a reading equal to the corrected NTU value determined when adding the turbidity of the dilution water to the nominal value of the standard.

Measurement Procedures

1. Turn power switch on and perform a battery check.
2. Press the appropriate range switch: 0-1, 0-10, 0-100 NTU.
3. Place the focusing template into the cell holder and adjust the Zero Control for a reading of zero NTU. Remove focusing template.
4. Fill a clean sample cell to the white line with the sample to be measured and place it into the cell holder. Use the white dot on the sample cell to orient the cell in the same position each time. Cover sample with light shield and allow meter to stabilize.

5. Read and record the turbidity of the sample.
6. Perform a duplicate sample every 10 or set of samples, whichever is more frequent.

Maintenance Procedure

1. Recharge battery on a regular basis.
2. Store in protective casing when not in use.
3. Keep records of usage, maintenance, calibration, and of any problems and repair.
4. After use the meter will be inspected and the inspection recorded in the field notebook.
5. A replacement meter will be ready for overnight shipment.
6. Keep nephelometric sample tubes clean both inside and out. Replace them when they become scratched or etched. Do not handle the tubes in the region where the light beam enters them.
7. Clean lens periodically.
8. Nephelometer will be sent back to the manufacturer for service when needed.

VII. Procedures for Measuring Dissolved Oxygen

The dissolved oxygen (DO) test is an important analysis in determining the quality of natural waters. The effects of wastes on rivers/streams, the suitability of water for fish and other organisms, and the progress of self-purification can be measured or estimated from the dissolved oxygen content.

Calibration Procedure

The dissolved oxygen meter will be calibrated daily, using the air calibration method.

1. Prepare the probe with a thin Teflon® membrane stretched over the sensor.
2. Perform a battery check and obtain a barometric pressure reading from a daily weather report.
3. With the unit off, adjust the meter pointer to zero with the screw in the center of the meter panel.
4. Switch dial to ZERO and adjust pointer using the ZERO knob.
5. Switch dial to FULL SCALE and adjust pointer using the FULL SCALE knob. Check batteries if pointer cannot reach full scale.
6. Attach probe to unit and tighten.
7. Turn unit on.
8. Allow 15 minutes for optimum probe stabilization and polarization.
9. Switch dial to CALIB O_2.
10. Hold probe in the air for 10 minutes or until reading is stable.
11. Using the CALIB knob, set the pointer to the mark associated with the local barometric pressure and ambient air temperature. If barometric pressure is unknown, a correction value of 97 percent should be used.

Operation Procedure

1. Calibrate the DO meter.
2. Perform the battery check.

3. Set mode switch to operate and the operation switch to the desired range.
4. Place probe into water sample.
5. Take a water temperature measurement and adjust temperature dial.
6. Switch to DO content measurement and allow reading to stabilize.
7. Record water temperature and DO on appropriate form or in the field notebook.

Maintenance Procedures

1. Replace batteries on a regular basis, at a suggested interval of every six months or every 1,000 hours of operation.
2. Store electrode in protective casing when not in use.
3. Keep records of usage, maintenance, calibration, and of any problems and repair.
4. A replacement DO meter will be ready for overnight shipment.
5. DO meter will be sent back to manufacturer for service when needed.

VIII. Equipment Cleaning

Equipment cleaning will be performed between each location as described in Appendix F.

IX. Disposal Methods

All water generated during cleaning procedures will be collected and contained on site for treatment with a portable activated carbon unit. The discharge will be sprinkled onto the surrounding ground sruface. After 2,000 gallons has been treated in the activated carbon unit, effluent will be sampled in order to determine if break-through has occurred.

Personal protective equipment, such as gloves, disposable clothing, and other disposable equipment resuting from personnel cleaning procedures and soil sampling and handling activities will be placed in plastic bags. These bags will be transferred into appropriately labeled 55-gallon drums for disposal at an appropriate hazardous waste facility, as necessary.

TABLE D-1

Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site

RI/FS Field Sampling Plan

Field Measurement Precision and Accuracy Control Limits

Field Parameter	Matrix Analyzed	Precision[1]	Accuracy
Temperature	Water/Air	± 1°C	±1°C (Instrument capability)
pH	Water	± 0.1 pH units	±1% pH units (Instrument capability)
Conductivity	Water	± 0.010 mS/cm	±5% standard
Turbidity	Water	± 1.0 NTU	±2% standard
Dissolved Oxygen	Water	± 0.02 mg/L	±5%

Note:

[1]Significant figures and units included

TABLE D-2

Allied Paper, Inc./Portage Creek/Kalamazoo River
Superfund Site

Allied Paper, Inc. Field Sampling Plan

Calibration Frequency and Preventative Maintenance

Maintenance	Frequency
THERMOMETER	
store in protective casing	D
inspect equipment after use	D
have a replacement thermometer available	D
NEPHELOMETER (TURBIDITY)	
store in protective casing	D
inspect equipment after use	D
clean sample cells	D
clean lens	M or X
check and recharge batteries	D
keep log book on instrument	D
have replacement meter available	D
return to manufacturer for service	X
calibration	D
CONDUCTIVITY, pH, DISSOLVED OXYGEN METERS	
store in protective casing	D
inspect equipment after use	D
clean probe	D
keep log book on instrument	D
have replacement meter available	D
replace probes	X
return to manufacturer for service	X
calibration	D

Notes:
D = daily
M = monthly
X = operator's discretion

ATTACHMENT D-1 (TO APPENDIX D)

TEMPERATURE/pH/CONDUCTIVITY METER
CALIBRATION AND MAINTENANCE LOG

TEMPERATURE/pH/CONDUCTIVITY METER CALIBRATION AND MAINTENANCE LOG

INSTRUMENT MANUFACTURER ________________________________

INSTRUMENT MODEL ________________________________

IDENTIFICATION NUMBER ________________________________

DATE/TIME	INITIALS	TEMPERATURE	pH STANDARD USED/ EXPIRATION	CONDUCTIVITY STANDARD USED/ EXPIRATION	BATTERY CHECK	COMMENTS

ATTACHMENT D-2 (TO ATTACHMENT D)

TURBIDITY METER FIELD CALIBRATION LOG

TURBIDITY METER FIELD CALIBRATION LOG

INSTRUMENT MANUFACTURER ______________________

INSTRUMENT MODEL ______________________

IDENTIFICATION NUMBER ______________________

DATE/TIME	INITIALS	CALIBRATION STANDARD	MEASURED TURBIDITY	BATTERY CHECK	COMMENTS

ATTACHMENT D-3 (TO ATTACHMENT D)

DISSOLVED OXYGEN METER CALIBRATION AND MAINTENANCE LOG

DISSOLVED OXYGEN METER CALIBRATION AND MAINTENANCE LOG

INSTRUMENT MANUFACTURER ______________________

INSTRUMENT MODEL ______________________

IDENTIFICATION NUMBER ______________________

DATE/ TIME	INITIALS	WATER TEMPERATURE	ACTUAL D.O.	MEASURED D.O.	BATTERY CHECK	MEMBRANE CHECKED/ REPLACED	COMMENTS

APPENDIX E

PHOTOIONIZATION DETECTOR (PID) FIELD SCREENING PROCEDURES

PHOTOIONIZATION DETECTOR (PID) FIELD SCREENING PROCEDURES

I. Introduction

Field screening with a photoionization detector (PID) is a procedure to measure relative concentrations of volatile organic compounds (VOCs) and other compounds. The characteristics of the PID are presented in Attachment E-1; the compounds which it can detect are presented in Attachment E-2. Field screening will be conducted on the following:

- Work area air to assess exposure to on-site workers of air contaminants via the air pathway;
- Well headspaces as a precautionary measure each time the well cover is opened; and
- Headspace of soil/residual samples to assess the relative concentration of volatile organics in the sample.

II. Materials

The following materials, as required, shall be available while performing PID field screening:

- Personal protective equipment (as required by the Health and Safety Plan);
- PID and operating manual;

- Calibration canisters for PID;
- Draeger tubes;
- Hand pump for Draeger tubes;
- Sample jars;
- Aluminum foil; and
- Field notebook.

III. PID Calibration

PID field instruments will be calibrated and operated to yield "total organic vapor" in ppm (v/v) as benzene. PID operation maintenance and calibration shall be performed in accordance with the manufacturer's instructions and entered on the PID calibration and maintenance log (Attachment E-3). Table E-1 presents PID calibration frequency and preventive maintenance information.

1. Don personal protective equipment (as required by the Health and Safety Plan).
2. Turn the FUNCTION switch to the BATTERY CHECK position. Check that the indicator is within or beyond the green battery arc. If indicator is below the arc or the red LED is lit, the battery must be charged.

3. Turn the FUNCTION switch to the STANDBY position and rotate the ZERO POTENTIOMETER until the meter reads zero. Wait 15 to 20 seconds to confirm the adjustment. If unstable, readjust.
4. Check to see that the SPAN POTENTIOMETER is adjust for the probe being used (e.g., 9.8 for 10.2 eV).
5. Set the FUNCTION switch to the desired ppm range (0-20, 0-200, or 0-2,000). A violet glow from the UV source should be visible at the sample inlet of the probe/sensor unit.
6. Listen for the fan operation to verify fan function (HNu only).
7. Connect one end of the sampling hose to the calibration canister regulator outlet and the other end to the sampling probe of the PID. Crack the regulator valve and take a reading after 5 to 10 seconds. Adjust the span potentiometer to produce the concentration listed on the span gas cylinder. Record appropriate information on the field calibration log (Attachment E-3 or equivalent).
8. If so equipped, set the alarm at desired level.

IV. Work Area Air Monitoring Procedure

1. Measure and record the background PID reading.
2. Measure and record breathing space reading.

Draeger tubes are used to measure the concentrations of specific vapors that cause a discoloration proportional to the amount of vapor present. For this site, the levels of benzene and trichloroethene will be measured. The procedures for using Draeger tubes are presented below:

1. The pump integrity must be checked each operational day. Block the pump inlet with an unopened tube, fully compress pump bellows, release. If the bellows do not completely fill in 30 minutes, the unit is operating properly. If the bellows do fill in 30 minutes, fix or replace the pump.
2. Check the expiration date on the Draeger tube. If valid, break off both tips of the tube in the break-off eyelet on the front pump plate.
3. Tightly insert the tube into the pump head with the arrow pointing toward the pump head.
4. Fully compress the bellows and allow the bellows to re-extend until chain is taut. Repeat as often as specified in the tube operating instructions. Each stroke of the bellows is 100 cubic centimeters of air.
5. Evaluate tube according to instructions.
6. Record Draeger tube measurements on appropriate form(s) or the field notebook.

7. At the end of the operating day, the pump should be checked for surface dirt and decontaminated following the procedures in Appendix F, if necessary. Also, deformities, cracks, and cuts should be looked for.

V. Sample Headspace Screening Procedure

Soil samples will be field screened upon collection with the PID for a relative measure of the total volatile organic concentration. PID readings will be recorded in the field notebook or the boring logs, whichever is appropriate.

1. Fill a clean glass jar with the sample (if sufficient quantities of soil are available) to be analyzed. Quickly cover the open top with one or two sheets of clean aluminum foil and subsequently apply screw cap to tightly seal the jar;
2. Allow headspace development for at least ten minutes. Vigorously shake jar for 15 seconds both at the beginning and end of the headspace development period. Where ambient temperatures are below 32°F (0°C), headspace development should be within a heated building;
3. Subsequent to headspace development, remove screw lid to expose the foil seal. Quickly puncture foil seal with instrument sampling probe, to a point about one-half of the headspace depth. Exercise care to

avoid contact with water droplets or soil particulates. As an alternative, syringe withdrawal or a headspace sample with subsequent injection to an instrument probe or septum-fitted inlet is acceptable contingent upon verification of methodology accuracy using a test gas standard; and

4. Following probe insertion through foil seal and/or sample injection to probe, record the highest meter response for the sample as the jar headspace concentration. Using the foil seal/probe insertion method, maximum response should occur between two and five seconds. Erratic meter response may occur at high organic vapor concentrations or conditions of elevated headspace moisture, in which case headspace data should be recorded and erratic meter response noted.

VI. Equipment Cleaning

After each use, the readout unit should be wiped down with a clean cloth or paper towel.

The UV light source window and ionization chamber should be cleaned in the following manner once a month:

1. With the PID off, disconnect the sensor/probe from the unit.
2. Remove the exhaust screw, grasp the end cap in one hand and the probe shell in the other, and pull apart.

3. Loosen the screws on the top of the end cap, and separate the end cap and ion chamber from the lamp and lamp housing.
4. Tilt the lamp housing with one hand over the opening so that the lamp slides out into your hand.
5. Clean the lamp with lens paper and HNu cleaning compound (except 11.7 eV). For the 11.7 eV lamp use a chlorinated organic solvent.
6. Clean the ion chamber using methanol on a Q-tip® and then dry gently at 50°C to 60°C for 30 minutes.
7. Following cleaning, reassemble by first sliding the lamp back into the lamp housing. Place ion chamber on top of the housing, making sure the contacts are properly aligned.
8. Place the end cap on top of the ion chamber and replace the two screws, tighten the screws only enough to seal the o-ring.
9. Line up the pins on the base of the lamp housing with pins inside the probe shell and slide the housing assembly into the shell.

TABLE E-1

Allied Paper, Inc./Portage Creek/Kalamazoo River
Superfund Site

RI/FS Field Sampling Plan

Photoionization Detector
Calibration Frequency and Preventative Maintenance

Maintenance	Frequency
store in protective casing	D
inspect equipment after use	D
check and recharge batteries	D
clean UV lamp and ion chamber	M or X
keep log book on instrument	D
have replacement meter available	D
return to manufacturer for service	X
calibration	after ten analyses or D

Notes:
D = daily
M = monthly
X = operator's discretion

ATTACHMENT E-1 (TO APPENDIX E)

CHARACTERISTICS OF THE PHOTOIONIZATION DETECTOR (PID)

CHARACTERISTICS OF THE PHOTOIONIZATION DETECTOR (PID)

I. Introduction

Photoionization detectors (PIDs) are used in the field to detect a variety of compounds in air. PIDs can be used to detect leaks of volatile substances in drums and tanks, to determine the presence of volatile compounds in soil and water, and to make ambient air surveys. If personnel are thoroughly trained to operate the instrument and to interpret the data, these PID instruments can be a valuable tool. Its use can help in deciding the level of protection to be worn, assist in determining the implementation of other safety procedures, and in determining subsequent monitoring or sampling locations.

Portable PIDs detect the concentration of organic gases as well as a few inorganic gases. The basis for detection is the ionization of gaseous species. The incoming gas molecules are subjected to ultraviolet (UV) radiation, which ionizes molecules that have an ionization potential (IP) less than or equal to that rated for the UV source. Every molecule has a characteristic IP, which is the energy required to remove an electron from the molecule, thus yielding a positively charged ion and the free electron. These ions are attracted to an oppositely charged electrode, causing a current and an electric signal to the LED display. Compounds are measured on a parts per million (ppm) volume basis.

II. HNu PI-101

The HNU portable photoionizer detects the concentration or organic gases as well as a few inorganic gases. The basis for detection is the ionization of

gaseous species. The incoming gas molecules are subjected to ultraviolet (UV) radiation, which is energetic enough to ionize many gaseous compounds. Each molecule is transformed into charged ion pairs, creating a current between two electrodes. Every molecule has a characteristic ionization potential (IP), which is the energy required to remove an electron from the molecule, yielding a positively charged ion and the free electron.

Three probes, each containing a different UV light source, are available for use with the HNu. Energies are 9.5, 10.2, and 11.7 electron volts (eV), respectively. All three probes detect many aromatic and large-molecule hydrocarbons. The 10.2 eV and 11.7 eV probes, in addition, detect some smaller organic molecules and some halogenated hydrocarbons. The 10.2 eV probe is the most useful for environmental response work, as it is more durable than the 11.7 eV probe and detects more compounds than the 9.5 eV probe. The 10.2 eV probe will be used for all PID screenings related to field activities at this Site. A listing of molecules and compounds that the HNu can detect is presented in Attachment E-2.

The primary HNu calibration gas is either benzene or isobutylene. The span potentiometer knob is turned to 9.8 for benzene calibration. A knob setting of zero increases the sensitivity to benzene approximately tenfold. Its lower detection limit is in the low ppm range. Additionally, response time is rapid; the dot matrix liquid crystal displays 90 percent of the indicated concentration in three seconds.

III. MicroTIP®

The MicroTIP® photoionizer detects the concentrations of organic gases, as well as a few inorganic gases in the same manner as the HNu. The MicroTIP also operates by detecting gaseous species that are ionized when subjected to ultraviolet radiation.

The MicroTIP® is equipped with a 10.6 eV probe, which detects more gaseous compounds and is more durable than any other eV probe.

The primary MicroTIP® calibration gas is isobutylene, which is equivalent in response to benzene. The MicroTIP® memory capabilities allows for calibration to four other gases in addition to isobutylene.

IV. Limitations

Both of these instruments can monitor several vapors and gases in air. Many non-volatile liquids, toxic solids, particulates, and other toxic gases and vapors, however, cannot be detected with PIDs. Since the PIDs cannot detect all the chemicals that may be present at a sample location, a zero reading on either instrument does not necessarily signify the absence of air contaminants.

The instruments are generally not specific, and their response to different compounds is relative to the calibration gases. Instrument readings may be higher or lower than the true concentration. This effect can be observed when monitoring total contaminant concentrations if several different compounds are being detected at once. In addition, the response of these instruments is not linear over the entire detection range. Therefore, care must be taken when interpreting the data. Concentrations should be reported in terms of the calibration gas and span potentiometer or gas-select-knob setting.

PIDs are small, portable instruments and may not yield results as accurate as laboratory instruments. PIDs were originally designed for specific industrial applications. They are relatively easy to use and interpret when detecting total concentrations of known contaminants in air, but interpretation becomes more difficult when trying to identify the individual components of a mixture. Neither instrument can be used as an indicator for combustible gases or oxygen deficiency.

This FSP intends for the PIDs to be used only as a guide for work area air monitoring to establish action levels (as defined in the Health and Safety Plan) and sample headspace screening to determine relative organic compound concentration.

ATTACHMENT E-2 (TO APPENDIX E)

MOLECULES AND COMPOUNDS DETECTED BY A PHOTOIONIZATION DETECTOR

ATTACHMENT E-2

Allied Paper, Inc./Portage Creek/Kalamazoo River
Superfund Site

Molecules and Compounds Detected by a Photoionization Detector (PID)

Some Atoms and Simple Molecules

	IP(eV)		IP(eV)
H	13.595	I_2	9.28
C	11.264	HF	15.77
N	14.54	HCl	12.74
O	13.614	HBr	11.62
Si	8.149	HI	10.38
S	10.357	SO_2	12.34
F	17.42	CO_2	13.79
Cl	13.01	COS	11.18
Br	11.84	CS_2	10.08
I	10.48	N_2O	12.90
H_2	15.426	NO_2	9.78
N_2	15.580	O_3	12.80
O_2	12.075	H_2O	12.59
CO	14.01	H_2S	10.46
CN	15.13	H_2Se	9.88
NO	9.25	H_2Te	9.14
CH	11.1	HCN	13.91
OH	13.18	C_2N_2	13.8
F_2	15.7	NH_3	10.15
Cl_2	11.48	CH_3	9.840
Br_2	10.55	CH_4	12.98

Paraffins and Cycloparaffins

Molecule	IP(eV)
methane	12.98
ethane	11.65
propane	11.07
n-butane	10.63
i-butane	10.57
n-pentane	10.35
i-pentane	10.32
2,2-dimethylpropane	10.35
n-hexane	10.18
2-methylpentane	10.12
3-methylpentane	10.08
2,2-dimethylbutane	10.06
2,3-dimethylbutane	10.02
n-heptane	10.08
2,2,4-trimethylpentane	9.86
cyclopropane	10.06
cyclopentane	10.53
cyclohexane	9.88
methylcyclohexane	9.85

(See notes on page 8)

ATTACHMENT E-2
(Cont'd.)
Allied Paper, Inc./Portage Creek/Kalamazoo River
Superfund Site

Molecules and Compounds Detected by a Photoionization Detector (PID)

Alkyl Halides Molecule	IP(eV)
HCl	12.74
Cl_2	11.48
CH_4	12.98
methyl chloride	11.28
dichloromethane	11.35
trichloromethane	11.42
tetrachloromethane	11.47
ethyl chloride	10.98
1,2-dichloroethane	11.12
1-chloropropane	10.82
2-chloropropane	10.78
1,2-dichloropropane	10.87
1,3-dichloropropane	10.85
1-chlorobutane	10.67
2-chlorobutane	10.65
1-chloro-2-methylpropane	10.66
2-chloro-2-methylpropane	10.61
HBr	11.62
Br_2	10.55
methyl bromide	10.53
dibromomethane	10.49
tribromomethane	10.51
CH_2BrCl	10.77
$CHBr_2Cl$	10.59
ethyl bromide	10.29
1,1-dibromoethane	10.19
1-bromo-2-chloroethane	10.63
1-bromopropane	10.18
2-bromopropane	10.075
1,3-dibromopropane	10.07
1-bromobutane	10.13
2-bromobutane	9.98
1-bromo-2-methylpropane	10.09
2-bromo-2-methylpropane	9.89
1-bromopentane	10.10
HI	10.38
I_2	9.28

Alkyl Halides Molecule	IP(eV)
methyl iodide	9.54
diiodomethane	9.34
ethyl iodide	9.33
1-iodopropane	9.26
2-iodopropane	9.17
1-iodobutane	9.21
2-iodobutane	9.09
1-iodo-2-methylpropane	9.18
2-iodo-2-methylpropane	9.02
1-iodopentane	9.19
F_2	15.7
HF	15.77
$CFCl_3$ (Freon 11)	11.77
CF_2Cl_2 (Freon 12)	12.31
CF_3Cl (Freon 13)	12.91
$CHClF_2$ (Freon 22)	12.45
$CFBR_3$	10.67
CF_2Br_2	11.07
CH_3CF_2Cl (Genetron 101)	11.98
$CFCl_2CF_2Cl$	11.99
CF_3CCl_3 (Freon 113)	11.78
$CFHBrCH_2Cr$	10.75
CF_2BrCH_2Br	10.83
CF_3CH_2I	10.00
$n\text{-}C_3F_7I$	10.36
$n\text{-}C_3F_7CH_2Cl$	11.84
$n\text{-}C_3F_7CH_2I$	9.96

(See notes on page 8)

ATTACHMENT E-2
(Cont'd.)
Allied Paper, Inc./Portage Creek/Kalamazoo River
Superfund Site

Molecules and Compounds Detected by a Photoionization Detector (PID)

Aliphatic Alcohol, Ether, Thiol, and Sulfides

Molecule	IP(eV)
H_2O	12.59
methyl alcohol	10.85
ethyl alcohol	10.48
n-propyl alcohol	10.20
i-propyl alcohol	10.16
n-butyl alcohol	10.04
dimethyl ether	10.00
diethyl ether	9.53
n-propyl ether	9.27
i-propyl ether	9.20
H_2S	10.46
methanethiol	9.440
ethanethiol	9.285
1-propanethiol	9.195
1-butanethiol	9.14
dimethyl sulfide	8.685
ethyl methyl sulfide	8.55
diethyl sulfide	8.430
di-n-propyl sulfide	8.30

(See notes on page 8)

ATTACHMENT E-2
(Cont'd.)
Allied Paper, Inc./Portage Creek/Kalamazoo River
Superfund Site

Molecules and Compounds Detected by a Photoionization Detector (PID)

Aliphatic Aldehydes and Ketones

Molecule	IP(eV)
CO_2	13.79
formaldehyde	10.87
acetaldehyde	10.21
propionaldehyde	9.98
n-butyraldehyde	9.86
isobutyraldehyde	9.74
n-valeraldehyde	9.82
isovaleraldehyde	9.71
acrolein	10.10
crotonaldehyde	9.73
benzaldehyde	9.53
acetone	9.69
methyl ethyl ketone	9.53
methyl n-propyl ketone	9.39
methyl i-propyl ketone	9.32
diethyl ketone	9.32
methyl n-butyl ketone	9.34
methyl i-butyl ketone	9.30
3,3-dimethyl butanone	9.17
2-heptanone	9.33
cyclopentanone	9.26
cyclohexanone	9.14
2,3-butanedione	9.23
2,4-pentanedione	8.87

Aliphatic Acids and Esters

Molecule	IP(eV)
CO_2	13.79
formic acid	11.05
acetic acid	10.37
propionic acid	10.24
n-butyric acid	10.16
isobutyric acid	10.02
n-valeric acid	10.12
methyl formate	10.815
ethyl formate	10.61
n-propyl formate	10.54
n-butyl formate	10.50
isobutyl formate	10.46
methyl acetate	10.27
ethyl acetate	10.11
n-propyl acetate	10.04
isopropyl acetate	9.99
n-butyl acetate	10.01
isobutyl acetate	9.97
sec-butyl acetate	9.91
methyl propionate	10.15
ethyl propionate	10.00
methyl n-butyrate	10.07
methyl isobutyrate	9.98

(See notes on page 8)

ATTACHMENT E-2
(Cont'd.)
Allied Paper, Inc./Portage Creek/Kalamazoo River
Superfund Site

Molecules and Compounds Detected by a Photoionization Detector (PID)

Aliphatic Amines and Amides

Molecule	IP(eV)
NH_3	10.15
methyl amine	8.97
ethyl amine	8.86
n-propyl amine	8.78
i-propyl amine	8.72
n-butyl amine	8.71
i-butyl amine	8.70
s-butyl amine	8.70
t-butyl amine	8.64
dimethyl amine	8.24
diethyl amine	8.01
di-n-propyl amine	7.84
di-i-propyl amine	7.73
di-n-butyl amine	7.69
trimethyl amine	7.82
triethyl amine	7.50
tri-n-propyl amine	7.23
formamide	10.25
acetamide	9.77
N-methyl acetamide	8.90
N,N-dimethyl formamide	9.12
N,N-dimethyl acetamide	8.81
N,N-diethyl formamide	8.89
N,N-diethyl acetamide	8.60

Other Aliphatic Molecules with N Atom

Molecule	IP(eV)
nitromethane	11.08
nitroethane	10.88
1-nitropropane	10.81
2-nitropropane	10.71
HCN	13.91
acetonitrile	12.22
propionitrile	11.84
n-butyronitrile	11.67
acrylonitrile	10.91
3-butene-nitrile	10.39
ethyl nitrate	11.22
n-propyl nitrate	
methyl thiocyanate	10.065
ethyl thiocyanate	9.89
methyl isothiocyanate	9.25
ethyl isothiocyanate	9.14

(See notes on page 8)

ATTACHMENT E-2
(Cont'd.)
Allied Paper, Inc./Portage Creek/Kalamazoo River
Superfund Site

Molecules and Compounds Detected by a Photoionization Detector (PID)

Olefins, Cyclo-ofefins, Acetylenes

Molecule	IP(eV)
ethylene	10.515
propylene	9.73
1-butene	9.58
2-methylpropene	9.23
trans-2-butene	9.13
cis-2-butene	9.13
1-pentene	9.50
2-methyl-1-butene	9.12
3-methyl-1-butene	9.51
3-methyl-2-butene	8.67
1-hexene	9.46
1,3-butadiene	9.07
isoprene	8.845
cyclopentene	9.01
cyclohexene	8.945
4-methylcyclohexene	8.91
4-cinylcylohexene	8.93
cyclo-octatetraene	7.99
acetylene	11.41
propyne	10.36
1-butyne	10.18

Some Derivatives of Olefins

Molecule	IP(eV)
vinyl chloride	9.995
cis-dichloroethylene	9.65
trans-dichloroethylene	9.66
trichloroethylene	9.45
tetrachloroethylene	9.32
vinyl bromide	9.80
1,2-dibromoethylene	9.45
tribromoethylene	9.27
3-chloropropene	10.04
2,3-dichloropropene	9.82
1-bromopropene	9.30
3-bromopropene	9.7
$CF_3CCl=CClCF_3$	10.36
$n\text{-}C_5F_{11}CF=CF_2$	10.48
acrolein	10.10
crotonaldehyde	9.73
mesityl oxide	9.08
vinyl methyl ether	8.93
allyl alcohol	9.67
vinyl acetate	9.19

(See notes on page 8)

ATTACHMENT E-2
(Cont'd.)
Allied Paper, Inc./Portage Creek/Kalamazoo River
Superfund Site

Molecules and Compounds Detected by a Photoionization Detector (PID)

Aromatic Compounds	
Molecule	IP(eV)
benzene	9.245
toluene	8.82
ethyl benzene	8.76
n-propyl benzene	8.72
i-propyl benzene	8.69
n-butyl benzene	8.69
s-butyl benzene	8.68
t-butyl benzene	8.68
o-xylene	8.56
m-xylene	8.56
p-xylene	8.445
mesitylene	8.40
durene	8.025
styrene	8.47
alpha-methyl styrene	8.35
ethynylbenzene	8.815
napthalene	8.12
1-methylnapthalene	7.69
2-methylnapthalene	7.955
biphenyl	8.27
phenol	8.50
anisole	8.22
phenetole	8.13
benzaldehyde	9.53
acetophenone	9.27
benzenethiol	8.33
phenyl isocyanate	8.77

Aromatic Compounds	
Molecule	IP(eV)
phenyl isothiocyanate	8.520
benzonitrile	9.705
nitrobenzene	9.92
aniline	7.70
fluoro-benzene	9.195
chloro-benzene	9.07
bromo-benzene	8.98
iodo-benzene	8.73
o-dichlorobenzene	9.07
m-dichlorobenzene	9.12
p-dichlorobenzene	8.94
1-chloro-2-fluorobenzene	9.155
1-chloro-3-fluorobenzene	9.21
1-chloro-4-fluorobenzene	8.99
o-fluorotoluene	8.915
m-fluorotoluene	8.915
p-fluorotoluene	8.785
o-chlorotoluene	8.83
m-chlorotoluene	8.83
p-chlorotoluene	8.70
o-bromotoluene	8.79
m-bromotoluene	8.81
p-bromotoluene	8.67
o-iodotoluene	8.62
m-iodotoluene	8.61
p-iodotoluene	8.50
benzotrifluoride	9.68
o-fluorophenol	8.66

(See notes on page 8)

ATTACHMENT E-2
(Cont'd.)
Allied Paper, Inc./Portage Creek/Kalamazoo River
Superfund Site

Molecules and Compounds Detected by a Photoionization Detector (PID)

Heterocyclic Molecules

Molecule	IP(eV)
furan	8.89
2-methyl furan	8.39
2-furaldehyde	9.21
tetrahydrofuran	9.54
dihydropyran	8.34
tetrahydropyran	9.26
thiophene	8.860
2-chlorothiophene	8.68
2-bromothiophene	8.63
pyrrole	8.20
pyridine	9.32
2-picoline	9.02
3-picoline	9.04
4-picoline	9.04
2,3-lutidine	8.85
2,4-lutidine	8.85
2,6-lutidine	8.85

Miscellaneous Molecules

Molecule	IP(eV)
ethylene oxide	10.565
propylene oxide	10.22
p-dioxane	9.13
dimethoxymethane	10.00
diethoxymethane	9.70
1,1-dimethoxyethane	9.65
propiolactone	9.70
methyl disulfide	8.46
ethyl disulfide	8.27
diethyl sulfite	9.68
thiolacetic acid	10.00
acetyl chloride	11.02
acetyl bromide	10.55
cyclo-$C_6H_{11}CF_3$	10.46
(n-C_3F_7)(CH_3)C=O	10.58
trichlorovinylsilane	10.79
$(C_2F_5)_3N$	11.7
isoprene	9.08
phosgene	11.77

Notes:

Reference: HNu Systems, Inc., 1985
IP = Ionization Potential

ATTACHMENT E-3 (TO APPENDIX E)

PHOTOIONIZATION DETECTOR CALIBRATION AND MAINTENANCE LOG

PHOTOIONIZATION DETECTOR CALIBRATION AND MAINTENANCE LOG

INSTRUMENT MANUFACTURER ______________________

INSTRUMENT MODEL ______________________

IDENTIFICATION NUMBER ______________________

LAMP (Circle One) 9.5eV 10.2eV 11.7eV

DATE/ TIME	INITIALS	BATTERY CHECK	CALIBRATION STANDARD			SPAN POTENTIOMETER SETTING	COMMENTS
			SOURCE	TYPE	CONCENTRATION		

APPENDIX F

EQUIPMENT CLEANING PROCEDURES

EQUIPMENT CLEANING PROCEDURES

I. Introduction

Equipment cleaning areas will be located within or adjacent to a specific work area, as specified in the Health and Safety Plan. The equipment cleaning procedures described herein include pre-field, in the field, and post-field cleaning of sampling equipment. The sampling equipment consists of soil/residuals sampling equipment, well construction materials, ground-water sampling devices, sediment sampling devices, surface water collection devices, water testing instruments, down-hole geophysical instruments, and other activity-specific sampling equipment. The non-disposable equipment will be cleaned after completion of each sampling event. Cleaning procedures will be monitored by the performance of Quality Assurance/Quality Control (QA/QC) checks through sampling and analysis as described in the QAPP Section 9 - Internal Quality Control Checks.

II. Materials

The following materials, as required, shall be available during equipment cleaning:

- Personal protection equipment (as required in the Health and Safety Plan);
- Distilled/deionized water;
- Non-phosphate soap (Alconox® or equivalent);
- Tap water;

- Appropriate cleaning solvent (e.g., methanol);
- Nitric acid;
- High-pressure water/steam cleaning unit;
- Wash basins;
- Brushes;
- Polyethylene sheeting;
- Aluminum foil;
- Plastic overpack drum or garbage can;
- Large heavy-duty garbage bags;
- Spray bottles (to hold soapy water, tap water, distilled/deionized water, methanol, or nitric acid); and
- Disposable [Polyvinyl Chloride (PVC) or nitrile] gloves.

III. Storage of Equipment

All decontaminated sampling equipment will be stored in a clean environment and, where appropriate, the equipment will be covered with aluminum foil.

IV. Safety Procedures During Equipment Cleaning

1. Personnel will wear the following personal protection equipment when cleaning smaller sampling equipment (e.g., split-spoon sampler, trowels):
    - Safety glasses, goggles, or a splash shield; and
    - PVC or nitrile outer gloves.

2. Personnel will wear the following additional personal protection equipment when cleaning larger equipment (e.g., drilling rigs) with a high-pressure water/steam cleaning unit:
    - Safety glasses, goggles, splash shield;
    - PVC or nitrile outer gloves;
    - Laminated-type Tyvek® disposable coveralls; and
    - Chemically resistant overboots.
3. All solvent rinsing will be conducted in an adequately ventilated area.
4. All solvents transported into the field will be stored and packaged in appropriate containers with care taken to avoid exposure to extreme heat.
5. Handling of solvents will be consistent with the manufacturer's Material Safety Data Sheets (MSDS). The MSDS for the solvent used during decontamination (methanol) can be found in the Health and Safety Plan.

V. Field Cleaning Procedures

A. Cleaning Station

Selection of a field equipment cleaning station location will be important. It will be located away from the immediate work area so as not to adversely impact the cleaning procedure, but close enough to the sampling teams to keep equipment handling to a minimum.

A designated area will be established to conduct all cleaning at each work area of the Site. All equipment such as drill rigs, backhoes, and

other mobile equipment will receive an initial cleaning prior to use at the Site. The frequency of subsequent cleaning while on site will depend on the extent to which the equipment is actually used in relation to the collection of environmental samples.

B. Decontamination of Smaller Sampling Equipment

Cleaning of smaller sampling equipment (e.g., split-spoon samplers, bailers, trowels) will follow the decontamination procedures presented in Table F-1. The first step, a non-phosphate soap and tap water wash, is to remove all visible particulate matter and residual oil and grease. This may be preceded by a steam cleaning to facilitate solids removal. When samples are to be analyzed for organic constituents, the soap and tap water wash will be followed by a tap water rinse to remove the detergent and a triple rinse sequence of solvent (e.g., methanol) and distilled/deionized water. When analyzing for inorganic constituents, the soap and tap water wash will be followed by a nitric acid rinse and a distilled/deionized water rinse.

C. Decontamination of Heavy Equipment

Other equipment and material associated with sampling events will be cleaned prior to use. Items such as drill rigs, well casings, and auger flights could contain potential sources of interference to environmental samples. The sampling equipment may have come in contact with the materials adjacent to the matrix being sampled or media may be attached to the actual sampling equipment. Heavy equipment may also retain contaminants from other sources such as roadways or storage areas or

material from previous job sites that were not adequately removed. For these reasons, it is important that these items be cleaned prior to use during the Site Investigation.

Two methods are used for cleaning heavy equipment: steam cleaning and manual scrubbing. Steam cleaning can remove visible debris. Since steam cleaners provide a high pressure medium they are very effective for solids removal. They are also easy to handle and generate low volumes of wash solutions.

A second method involves manual scrubbing of equipment using brushes and the procedures detailed in Table F-1. This procedure can be as effective as steam cleaning and is preferred in situations where steam cleaning fails to remove visible materials. Disadvantages to manual scrubbing are that it is labor intensive and it generates large volumes of wash and rinse solutions.

Heavy equipment will be thoroughly steam cleaned or manually scrubbed upon arrival on site and when moved between sampling locations. Drill rig items such as auger flights, drill rods, and drill bits will be cleaned before changing sample locations.

VI. Disposal Methods

All water generated during cleaning procedures will be collected and contained on site for treatment with a portable activated carbon unit with the discharge being sprinkled onto the surrounding ground surface. After 2000 gallons has been treated in the activated carbon unit, effluent will be sampled

in order to determine if break-through has occurred. At the Allied Paper Operable Unit, water generated will be treated with the existing activated carbon unit and discharged to the Kalamazoo Water Reclamation Facility.

Personal protective equipment, such as gloves, disposable clothing, and other disposable equipment, resulting from personnel cleaning procedures, will be placed in plastic bags. These bags will be transferred into appropriately labeled 55-gallon drums for disposal at an appropriate hazardous waste facility, as necessary.

TABLE F-1

EQUIPMENT CLEANING

The field sampling equipment cleaning procedures when analyzing for organic constituents are as follows:

1. Non-phosphate soap (Alconox[R] or equivalent) and tap water wash;
2. Tap water rinse;
3. Solvent rinse (e.g., methanol);
4. Distilled/deionized water rinse; and
5. Repeat solvent and water rinse two more times (i.e., triple rinse) and allow to air dry.

The field sampling equipment cleaning procedures when analyzing for inorganic constituents are as follows:

1. Non-phosphate soap (Alconox[R] or equivalent) and tap water wash;
2. Nitric acid rinse;
3. Distilled/deionized water rinse; and
4. Allow to air dry.

APPENDIX G

HANDLING, PACKING, AND SHIPPING PROCEDURES

HANDLING, PACKING, AND SHIPPING PROCEDURES

I. Handling

1. Fill in sample label (Attachment G-1) with:
   - Sample type (e.g., soil, sediment, water);
   - Project number;
   - Sample identification, including site name and sample interval, if applicable;
   - Analysis required;
   - Date;
   - Time sampled;
   - Name, affiliation, and phone number of person preparing label;
   - Mode of collection (composite or grab); and
   - Preservation added, if applicable.
2. Cover the label with clear packing tape to secure the label onto the container.
3. Check the caps on the sample containers so that they are tightly sealed.
4. Mark the level of the sample in the container using an indelible ink marker or grease pencil.
5. Wrap the sample container cap with clear packing tape to prevent it from becoming loose.
6. Place a signed custody seal label (Attachment G-2) over the cap such that the cap cannot be removed without breaking the custody seal.

II. Packing

1. Using duct tape, secure the outside and inside of the drain plug at the bottom of the cooler that is used for sample transport.
2. Place each sample container in individual 2-ml thick (minimum) polyethylene bags (Ziploc^{R}-type) and seal.
3. Place 1 to 2 inches of vermiculite or other cushioning material at the bottom of the cooler.
4. Place the sealed container and bag upright in the cooler.
5. Repackage ice (if required) in small Ziploc^{R}-type plastic bags and place loosely in the cooler. Do not pack ice so tightly that it may prevent addition of sufficient cushioning material.
6. Fill the remaining space in the cooler with vermiculite or other cushioning material.
7. Place the chain-of-custody forms (Attachment G-3) in a large Ziploc^{R}-type bag and tape the forms to the inside of the cooler lid.
8. Close the lid of the cooler and fasten with duct tape.
9. Wrap strapping tape around both ends of the cooler at least twice.
10. Mark the cooler on the outside with the following information: return address, "Fragile" labels (Attachment G-4) on the top and on one side, and arrows indicating "This Side Up" (Attachment G-4) on two adjacent sides.
11. Place a signed custody seal label (Attachment G-2) over front right and back left of the cooler lid and cover with clear plastic tape.

III. Shipping

1. Environmental samples will be shipped according to 40 CFR 761.65(i)(3).
2. All samples will be delivered by an express carrier, allowing for sufficient time for analysis to be performed within the holding time periods specified in Table 3-1.
3. The following chain-of-custody procedures will apply to sample shipping:
   - Relinquish the sample containers to the laboratory via express carrier. The signed and dated forms should be taped inside the top of the cooler. The express carrier will not be required to sign the chain-of-custody forms.
   - When the samples are received by the laboratory, the laboratory personnel shall complete the chain-of-custody forms by signing and dating to acknowledge receipt of samples. The internal temperature of the shipping container is measured and recorded. The sample identification numbers on the containers are then checked to insure that they are consistent with the chain-of-custody forms.

ATTACHMENT G-1 (TO APPENDIX G)

SAMPLE LABEL

BLASLAND & BOUCK ENGINEERS, P.C.

		PROJECT #
SAMPLE I.D.		DATE
SAMPLE TYPE ☐ Soil/Sediment ☐ Water	COLLECTION MODE ☐ Composite ☐ Grab	TIME
ANALYSIS		
SAMPLER(S)		PRESERVATIVE

07/92 DJH
66102O1C/66102N05.CDR

ATTACHMENT G-2 (TO APPENDIX G)

CUSTODY SEAL LABEL

aquatec INC.

An Inchcape Company
55 South Park Drive, Colchester, Vermont 05446
TEL: 802/655-1203

CUSTODY SEAL

SEALED BY

_____

DATE _____ TIME _____

I-CHEM

Chemists In The Container Business™

CUSTODY SEAL

Date _____

Signature _____

ATTACHMENT G-3 (TO APPENDIX G)

CHAIN-OF-CUSTODY FORM

BLASLAND & BOUCK ENGINEERS, P.C.
6723 Towpath Road, Box 66
Syracuse, New York 13214-0066
TEL: 315-446-9120
FAX: 315-449-0017

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME					Number of Containers							
SAMPLERS: *(Signature)*													
STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION								REMARKS

Relinquished by: *(Signature)*	DATE	TIME	Received by: *(Signature)*	Relinquished by: *(Signature)*	DATE	TIME	Relinquished by: *(Signature)*	
Relinquished by: *(Signature)*	DATE	TIME	Received by: *(Signature)*	Relinquished by: *(Signature)*	DATE	TIME	Relinquished by: *(Signature)*	
Relinquished by: *(Signature)*	DATE	TIME	Received for Laboratory by: *(Signature)*	DATE	TIME	Remarks:		

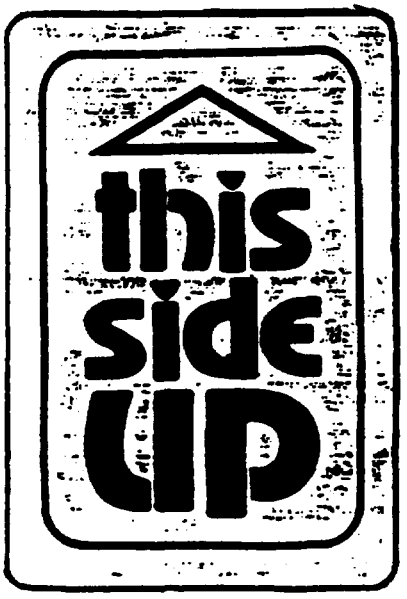
5/3/90
1393786\COR

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

ATTACHMENT G-4 (TO APPENDIX G)

FRAGILE AND THIS SIDE UP LABELS


fragile
HANDLE
WITH CARE


this
side
up

APPENDIX H

IMMUNOASSAY PCB-TESTING PROCEDURES

FIELD SCREENING FOR PCBs USING EnSYS CORP.

PCB RISc™ IMMUNOASSAY

I. Application

Field screening is used to provide real-time analytical data to make field decisions for remedial activities. These techniques are particularly useful for defining the extent of site contamination and for the identification of hotspots and clean areas. Field screening can also be used to pre-screen samples before they are sent for analysis to reduce laboratory sample load.

II. Summary of Method

Immunoassays are immunochemical detection methods based on the specific binding properties of an antibody for a target analyte. Quantitation is performed based on color changes which occur in the presence of PCBs. The degree of color change is inversely proportional to the amount of PCBs present in the sample.

III. Materials

The materials required for use of an immunoassay field screening device include:

- Personal protective equipment, including disposable latex gloves (as specified in the Health and Safety Plan);
- Cleaning equipment;
- Test kit purchased from the manufacturer with the expiration date checked before use;

- Spectrophotometer and batteries;
- Mechanical pipette;
- Replacement pipette tips;
- Balance - capable of weighing to 0.1g;
- Permanent marker;
- Laboratory tissue/absorbent paper;
- Timer or stopwatch;
- Aluminum tray; and
- Stainless steel spatula.

IV. Procedures

A detailed procedure for using EnSys Corporation's PCBRisc™ kit is as follows:

A. Sample Preparation

1. Don appropriate personal protective equipment (as required by the Health and Safety Plan).
2. Composite a previously collected soil/sediment/residual sample using the stainless steel spatula on the aluminum tray and allow to air dry.
3. Weigh out 10±0.1 g of composited soil/sediment/residuals using the weight boat provided in the test kit.
4. Transfer the sample to the extraction jar, recap the jar, shake vigorously for one minute, and then let settle for one minute.
5. Remove lid from extraction jar, disassemble filtration plunger from filtration barrel, insert bulb pipette into liquid in extraction jar and draw up sample; and

6. Transfer at least half the bulb capacity into filtration barrel, press plunger firmly into the barrel until at least 1/2 milliliter (ml) of filtered sample is available.

B. Dilution & Buffering of Samples & Standards

1. Using a permanent marker write "Standard 1", "Standard 2", and "1 ppm" near the top of a buffer tube and an antibody coated tube, place these tubes in the workstation.
2. Inset a new tip onto the mechanical pipette.
3. Withdraw 30 microliters (uL) of filtered sample using the mechanical pipette and dispense below the liquid level in the 1 ppm dilution vial, withdraw another 30 uL of the filtered sample and add to the vial the same way, replace the cap on the vial and gently shake for 5 seconds.
4. Withdraw 30 uL of diluted sample from the 1 ppm dilution vial and dispense below the liquid level in the 1 ppm blue buffer tube, gently shake the uncovered buffer tube for 5 seconds.
5. Replace the tip on the mechanical pipette.
6. Withdraw 30 uL from the PCB standard vial and dispense below the liquid level in the Standard 1 blue buffer tube, wipe pipette tip with laboratory tissue.
7. Withdraw 30 uL of PCB standard and dispense below the liquid level in the Standard 2 blue buffer tube, gently shake both blue buffer tubes for 5 seconds; and
8. Immediately replace cap on the PCB standard, and dispense the mechanical pipette tip.

C. Immunoassay

1. Start timing and immediately pour the solution from each standard blue buffer tube into the appropriate standard antibody covered tube, and pour the solution from the 1 ppm blue buffer tube into the 1 ppm antibody covered tube, gently shake the three tubes for 5 seconds, and let all three stand for exactly 10 minutes.
2. Crush glass ampule contained within the enzyme dropper by pressing dropper against a hard edge (prepare 1 enzyme dropper for every 5 antibody coated tubes), mix enzyme by turning dropper end-over-end 5 times, remove seal from dropper.
3. Discard the first drop from enzyme dropper, at exactly 10 minutes (step 15), start timing and immediately dispense 3 drops into each antibody coated tube by squeezing the dropper, when all tubes have had enzyme solution added, shake antibody covered tubes for 5 seconds, let tubes stand exactly 5 minutes.
4. After the time has elapsed, discard solution from the antibody coated tubes, keep nozzle of wash solution bottle just above the top of the tube and forcefully squeeze wash solution into each tube with a strong stream to fill each tube, discard wash solution, repeat 3 times, and then tap tubes upside down on a laboratory tissue; and
5. Add 5 drops of Substrate A to the bottom of each antibody covered tube, start timing, add 5 drops of Substrate B to the bottom of each antibody covered tube, shake all antibody covered tubes for 3 to 5 seconds, let stand for exactly 2.5 minutes, and then add 5 drops of Stop Solution.

D. Interpretation of Test Results

1. Wipe the outside of the Standard 1 and Standard 2 antibody coated tubes with laboratory tissue and place in the photometer.
2. If photometer readout is negative or zero, discard the tube from the right well, if the photometer reading is positive, discard the tube from the left well and transfer the tube in the right well to the left well.
3. Wipe the outside of the 1 ppm antibody coated tube with laboratory tissue and place in the right well of the photometer; and
4. If the photometer reading is negative or zero, PCBs are present in the sample, if the photometer reading is positive, the concentration of PCBs is less than 1 ppm.

FIELD SCREENING OF PCBs USING MILLIPORE ENVIROGARD™ IMMUNOASSAY

I. Application

Field screening is used to provide real-time analytical data to make field decisions for remedial activities. These techniques are particularly useful for defining the extent of site contamination and for the identification of hotspots and clean areas. Field screening can also be used to pre-screen samples before they are sent for analysis to reduce laboratory sample load.

II. Summary of Method

Immunoassays are immunochemical detection methods based on the specific binding properties of an antibody for a target analyte. Quantitation is performed based on color changes which occur in the presence of PCBs. The degree of color change is inversely proportional to the amount of PCBs present in the sample.

III. Materials

The materials required for use of an immunoassay field screening device include:

- Personal protective equipment, (as specified in the Health and Safety Plan);
- Cleaning equipment;
- Test kit purchased from the manufacturer with the expiration date checked before use;
- Spectrophotometer and batteries;

- Mechanical pipette;
- Replacement pipette tips;
- Balance capable of weighing to 0.1g;
- Permanent marker;
- Laboratory tissue/absorbent paper;
- Timer or stopwatch;
- Distilled/deionized water;
- Soil extraction kit;
- Methanol;
- Aluminum tray; and
- Stainless steel spatula.

IV. Procedures

A detailed procedure for using Millipore Corporation's EnviroGard™ kit is as follows:

A. Sample Preparation

1. Don appropriate personal protective equipment (as required by the Health and Safety Plan).
2. Composite a previously collected soil/sediment/residual sample using the stainless steel spatula on the aluminum tray and allow to air dry.
3. Label the test tubes as follows using permanent marker: NC (negative control), 5 ppm, 10 ppm, 50 ppm, and sample (more than one tube may be labelled as sample).
4. Weigh out 5±0.1 g of composited soil/sediment/residuals using the weight boat provided in the extraction kit.

5. Add soil and 5 ml of methanol to the solvent extraction bottle, cap and shake vigorously for 2 minutes.
6. Insert a prefilter unit into the filter end of the plunger unit.
7. Pour the soil/methanol mixture into the filter base unit (if the soil is clay-like and absorbs the methanol, add another 5 ml of methanol and shake for another 2 minutes; do not forget to compensate for the additional dilution); and
8. Insert plunger unit into the filter base unit, press down firmly on the plunger, wait 30 to 60 seconds, press plunger down again, add 5 uL of sample extract to a corresponding test tube, repeat steps 4 to 8 for each sample to be tested.

B. Immunoassay

1. Using the positive displacement pipettor, add 5 uL of methanol to the NC test tube, add 5 uL of calibrator solution to the corresponding test tube.
2. Position the repeater pipettor at setting 2 and use the 12.5 mL syringe to add 500 uL of assay diluent to all test tubes, shake the test tube rack to mix.
3. Wait 5 minutes, vigorously shake the liquid out of all test tubes, fill the tubes to overflowing with distilled water, decant, vigorously shake out remaining liquid, repeat three more times, tap the inverted tubes on laboratory tissue.
4. Use the 5 mL syringe to add 200 uL of the PCB enzyme conjugate to all test tubes, shake test tube rack to mix.

5. Wait 5 minutes, vigorously shake the liquid out of all test tubes, fill the tubes to overflowing with distilled water, decant, vigorously shake out remaining liquid, repeat three more times, tap the inverted tubes on laboratory tissue.
6. Use a new 5 mL syringe to add 200 uL of substrate to all test tubes, use another new 5 mL syringe to add 200 uL of chromogen to all test tubes, shake test tube rack to mix.
7. Wait 5 minutes, use a 12.5 mL syringe to add 500 uL of Stop Solution to all test tubes; and
8. Add 1 mL of stop solution to the blank test tube and insert into the left well of the spectrophotometer, dry the outside of each test tube and place in the right well of the spectrophotometer, measure the absorbance of the test tube, repeat for all test tubes.

C. Interpretation of Test Results

- Samples with absorbance values greater than or equal to the values of the 5 ppm standard contain less than 5 ppm PCB.
- Samples with absorbance values less than or equal to the 5 ppm standard may contain more than 5 ppm PCB.
- Samples with absorbance values greater than or equal to the 10 ppm standard contain less than 10 ppm PCB.
- Samples with absorbance values less than or equal to the 10 ppm standard may contain more than 10 ppm PCB.
- Samples with absorbance values greater than or equal to the value of the 50 ppm standard contain less than 50 ppm PCBs.

- Samples with absorbance readings less than or equal to the values for the 50 ppm standard may contain more than 50 ppm PCB.

Soil samples that were extracted with more than 1.0 ml of methanol per gram of soil require a correction factor in order to interpret the results. Multiply each of the calibrator concentrations by the ratio of methanol (ml) to soil (grams).